THE ILLUMINATING ENGINEER
THE JOURNAL OF
GOOD LIGHTING
LIGHT LAMPS FITTINGS AND ILLUMINATION
OIL · GAS ELECTRICITY ACETYLENE PETROL-AIR GAS ETC.
Official Organ of the Illuminating Engineering Society
FOUNDED IN LONDON 1908
Edited by J. STEWART DOW

Vol. XXIII April, 1930

Price NINEPENCE
Subscription 10/6 per annum, post free.
For Foreign Countries, 15/- per annum.

EDITORIAL AND PUBLISHING OFFICES:
32 VICTORIA STREET, LONDON, S.W. 1.
*Tel. No.: Victoria 5215*

# The Lighting of Kinema Studios

THE lighting of kinema studios, which was the subject of a paper by Mr. W. H. Villiers before the Illuminating Engineering Society on February 18th, is interesting as a case in which artificial methods are frequently preferred to natural ones.

Natural and artificial light can both be used, though for many subjects the artificial lighting, being under exact control, has decided advantages. When the film is shown in the theatre reliance is placed entirely on artificial light, so that altogether the kinema film industry is one of considerable interest to illuminating engineers. In the introductory portion of his paper Mr. Villiers briefly traced some of the changes in procedure that have affected lighting problems. One of the most important of these has been the introduction of the panchromatic film, sensitive to light in the yellow, orange and red, The early films were practically insensitive to light in this region; hence the almost invariable use in studios of highly actinic sources of light such as arc lamps and mercury-vapour lamps. The development of the panchromatic film and the simultaneous progress made in the production of incandescent lamps of high candle-power has favoured this form of lighting, which has certain other advantages such as ease of manipulation, absence of fumes or smoke and (in the case of talking films) noiselessness. The latter, indeed, has recently been regarded as one of the most important merits.

Much of the discussion turned upon the relative merits of arc and incandescent lamps. It may be conceded, as one of the speakers mentioned, that there have been fewer opportunities for arc lamps during recent years and, therefore, less effort has been spent on their development than in the case of incandescent lamps. On the other hand it was stated that important progress has been made lately, and that in some studios arc lamps are being reintroduced. Incidentally, one evident advantage of the arc, the small dimensions of the source which is advantageous when sharp shadows are desired, was mentioned. One of the most interesting points in the discussion, which has an important bearing on the use of arc lamps for studio work, was their applicability to studios devoted to the production of talking films. The necessity for special precautions to avoid extraneous noise, which is apt to be highly magnified, is well known. Apparently it is possible, by the judicious use of chokers, to eliminate the hum due to ripples in the electrical supply. But there remains the question whether arcs can be trusted never to hiss or splutter owing to imperfect adjustment. We have been assured that with modern well-designed types of arcs this possibility can be eliminated. But those in the film-making industry would do well to be discriminating in their choice of lamps when talking films are being made. Probably it will ultimately be found, as in so many other cases, that both methods of lighting have their advantages, and that in a well-equipped studio they will frequently be used in combination. If, as was hinted, talking films exhibiting natural colours and designed for a stereoscopic effect become usual in the future it will be interesting to see how this added complexity affects the relative merits of the two systems.

Perhaps the greatest drawback urged against the incandescent lamp was the great heat developed, which is apt to cause perspiration and affect the make-up of actors, as well as causing fatigue. This is a natural consequence of the very high illuminations (stated to be of the order of 800 foot-candles or more) commonly used in studios. Possibly, as Mr. Villiers mentioned, relief may come by other advances (such as the use of larger lens apertures) which may enable lower illuminations to be used. The point is one of some general importance in view of the tendency to advocate "super-illuminations" in other fields of lighting. We believe that in some factories in the United States illuminations as high as 150 foot-candles have been recorded. The heat in this case must surely have been noticeable. We have heard of cases when the atttempt to furnish 30 to 50 foot-candles from overhead units in concentrating reflectors was accompanied by a degree of radiant heat that was found distinctly uncomfortable.

Allusion was also made to a trouble that was not infrequent in studios some years ago, the tendency to eye-inflammation experienced by actors exposed to intense beams of light. This inflammation is doubtless specially acute when sources contain a high ultra-violet element, and appears to be infrequent with the less actinic sources needed for panchromatic films. At the same time one would think that the intense glare from powerful projectors, whether equipped with arcs or incandescent lamps, must in itself be troublesome. One wonders how artists are able to preserve a natural expression with such an intense beam directed on their faces. To an impartial observer, this would seem to be an additional argument in favour of the more restrained effects obtained from well-diffused light.

## Gas Lighting

THE paper read by Mr. F. J. Gould at Birmingham on February 8th gave expression to the feeling that more should be done by the gas industry to develop the lighting load, and that the tendency for lighting to recede into the background is due in a large measure to "sheer apathy." In the active development of heating and cooking, lighting business, which is possibly more difficult to get and less remunerative, is apt to be neglected. Showrooms are not infrequently occupied almost entirely by stoves and heating equipment; lighting fittings receive little space and are not shown with the same vim and enterprise. Lighting installations are not always properly maintained and modernized and may act as very poor advertisements for gas lighting, whereas a really successful installation, by appealing to the eye, serves as one of the best possible means of publicity. In particular Mr. Gould emphasized the vital importance of regular and systematic maintenance schemes.

All this is doubtless true, though, as Mr. Goodenough pointed out, apathy is not universal. He knew of no leaders in the gas industry who were apathetic in regard to gas lighting. He, too, emphasized the importance of maintenance and service to the consumer, quoting the Duke of York's remark in connection with overseas customers: "If we cannot satisfy them we perish."

In other sections of his paper Mr. Gould quoted figures on the cost of gas lighting and emphasized the relatively low intrinsic brightness of the incandescent mantle as an advantage. For our part we are inclined to think that too much importance is apt to be attached to both these factors. There are unquestionably cases, such as those involving large contracts for public lighting, etc., where economic considerations play a very important part. But, nevertheless, Mr. W. J. A. Butterfield was probably right in urging that it was usually best "to get away from price comparison." Interminable arguments about the possibility of saving trifling sums from the lighting bill were customary in the early days of both gas and electric lighting. Their unfortunate effect in leading consumers to regard lighting as primarily a service which was to be "scrimped" has not disappeared even to-day. There is now a saner attitude on the part of the public. The illuminating engineering movement is bringing about a recognition that the cost of lighting is invariably a small fraction of aggregate expenditure; that the main thing is to get the best and most satisfactory conditions of illumination; and that poor lighting is dear at any price.

Similarly it is really an out-of-date view to attach too much importance to comparisons between intrinsic brightnesses of sources of light. It is now universally accepted by experts that sources should be screened from direct vision. The tendency is to rely more and more on methods of lighting in which the source is completely concealed from view. The exact degree of intrinsic brightness of the source, within limits, is thus of much less moment than in the past.

It is perhaps not sufficiently recognized by unprogressive concerns how greatly novelty in design and picturesque effect help to kindle public interest, and how useful devices promoting more scientific direction and distribution of light may be. Promising ideas are not infrequently evolved, but somehow they do not seem to be developed in practice as widely as one might expect. The introduction of prismatic directing plates for street lanterns, first exhibited at the Sheffield Conference in 1929, was an enterprising departure. There are other ways in which more use might be made of diffusion to enhance the decorative appearance of units for public lighting. There is no reason why more concealed lighting and floodlighting should not be attempted with gas. Some good examples could be mentioned, but the possibilities in this direction do not seem to be sufficiently realized. To quote Mr. Gould: "Give consumers the same opportunity of decorative lighting effects as those provided by electricity undertakings. So many gas installations are dowdy and uninteresting in appearance!"

Next we should like to emphasize another method of developing interest in gas lighting—the organisation of lectures and demonstrations illustrating the benefits of good lighting and the distinction between good and bad methods. The presentation of data of this kind, besides being a public service, forms one of the best means of establishing connections. Those interested in gas lighting might do more in this way.

We may conclude by echoing the wish expressed by some of the leaders of this great national industry that it should identify itself more fully with the illuminating engineering movement and especially take a leading part in the great international congress which is to take place in this country next year.

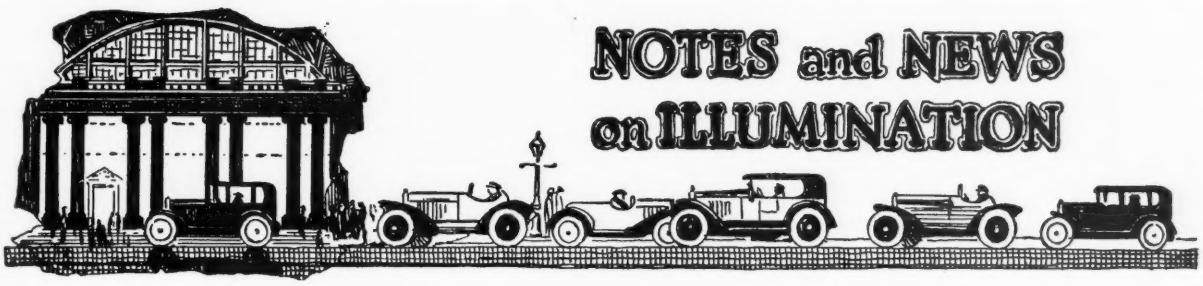
## The Work of the National Illumination Committee

WE reproduce in this issue the report of the Chairman of the National Illumination Committee of Great Britain, reviewing its work for the past year. This affords evidence of continued growth. A brief account is given of the work of fourteen committees dealing with the most varied subjects, most of which are in touch with corresponding sub-committees in other countries. The exchange of views with experts abroad is in itself a good thing, and the whole system paves the way very readily for international action.

All this work is additional to that undertaken by the committees concerned specifically with the coming International Illumination Congress, and is supplementary to that of numerous committees operating under the Illumination Section of the British Engineering Standards Association.

Finally, there is the Illumination Research Committee, formed by the Department for Scientific and Industrial Research, which likewise allots specific problems to sub-committees. The work of the three organizations is complementary. The National Illumination Committee is chiefly engaged in collecting information of international interest, the B.E.S.A. committees with standardization, and the Illumination Research Committees with research, and which could not be readily undertaken by private individuals. We doubt whether anything quite similar exists in other countries.

As the machinery outlined above has been moulded mainly by leading members of the Illuminating Engineering Society, that body should feel a pride in its development. In conclusion, we should like to call attention to one feature that is apt to be overlooked—the extraordinary amount of useful work done on a purely honorary basis by those who serve on these committees. Such efforts, indeed, deserve recognition and indicate that this is not quite such a purely materialistic age as is apt to be assumed.




## Association of Public Lighting Engineers

SEVENTH ANNUAL CONFERENCE IN LEICESTER.

We understand that the programme for the above conference, which is to be held in Leicester during September 8th to 11th, has already been practically completed. As usual, members and delegates will be received by the Lord Mayor on the opening evening (September 8th). The President's address will be followed by numerous special contributions. Papers in prospect include "The Practical Use of a Test Room," by Mr. W. L. Marshall and Mr. R. H. Redmill (members of the staff of the Leicester Lighting Department); "Modern Street Lighting by Gas," by Mr. Robert Watson (Doncaster); and "Street Lighting in Birmingham," by Mr. Robert Mason (Superintendent of Lighting, City of Birmingham). We understand that a joint paper by Mr. G. Wilson, of the G.E.C. Research Laboratory, and Dr. Thomas, Chief Physicist to the South Metropolitan Gas Company, is expected. Yet another item on the programme is a discussion on street lighting, in which the views of the pedestrian, the motorist and the ratepayer will be expressed—doubtless with candour. On September 9th lunch will be furnished at the invitation of the Leicester Watch Committee at the Grand Hotel, where the Association dinner will be held on the evening of Thursday, September 11th. Other events include a display of fire-fighting appliances by members of the Leicester Fire Brigade, a char-à-banc excursion to Charnwood Forest, and visits to various factories engaged in the manufacture of boots and shoes. The conference promises to an interesting one.

## A Lighting Exhibit at Charing Cross

The concours at the Charing Cross Tube Station has been the site of numerous special exhibits since the station was remodelled, most of which have been more or less closely related to transport. During the past month, however, there has been on view an exhibit exclusively concerned with lighting, organized by the E.L.M.A. Lighting Service Bureau. We give elsewhere an illustrated account of this display, which was a decidedly enterprising step. It certainly ought to catch the attention of many Londoners. The methods of lighting displayed, doubtless with deliberate intent, are of a highly modern character. "The electric eye," which enabled visitors to flood the room with coloured light by merely intercepting the beams from three parallel cylinders, has proved a source of constant interest.

## A Study of Glare

A technical paper (No. 8) entitled "The Effect of Glare on the Brightness Difference Threshold," which summarizes the researches of Mr. W. S. Stiles, has recently been issued by the Illumination Research Committee (Department of Scientific and Industrial Research)*. The results of this research are embodied in numerous tables and diagrams. Some interesting notes on measurements of pupil diameters as a means of estimating glare are included in an appendix. It would perhaps be unreasonable to expect the conclusions drawn from such a specialized and elaborate investigation to be stated too positively. No doubt the relations being established will enable the investigators to feel their way towards simple and definite recommendations and will influence future rules for the avoidance of glare. Nevertheless, as such data are apt to prove "caviare to the general," one would like to be accompanied by a brief statement, in popular terms, of their bearing on practical problems.

* Illumination Research; Technical Paper No. 8 (Obtainable from H.M. Stationery Office; 2s. 6d. net).

## The B.E.S.A. Dinner

The commemoration dinner of the British Engineering Standards Association held on March 6th was a pleasant event. The Association well deserved the honour of securing as its chief guest of honour H.R.H. the Duke of York, who paid a tribute to the remarkable work it has achieved. In judging this work it should be borne in mind that the B.E.S.A. possesses no legislative authority. Also, although it receives the help in council of numerous representatives of Government Departments, it is not subject to Government control. It is, therefore, a triumph of voluntary effort that its specifications are universally accepted by British manufacturers as well as the great majority of purchasers. His Royal Highness also alluded to the care exercised to prevent standardization interfering with progressive design, and to the influence which it is able to exert in the direction of Imperial agreement. In proposing the toast of the Association he heartily congratulated it on the granting of a Royal Charter. The Chairman (Mr. Maurice F. G. Wilson), in responding, gave a brief survey of the work of the B.E.S.A., through its committees, now about 500 in number, which furnishes a remarkable illustration of what the spirit of co-operation can do. M. Ll. B. Atkinson, in proposing the toast of "The Guests," referred especially to Lord Thomson, the Minister of Air, to Mr. H. J. Skelton, "the father of British standardization," and to Mr. C. Le Maistre, the director of the B.E.S.A.

## Mr. E. H. Horstmann

We reproduce a photograph of Mr. E. Hermann Horstmann, Secretary and Managing Director of the Horstmann Gear Company Ltd., whose death we recorded last issue. Besides being exceedingly skilful in his own particular field, Mr. Horstmann was a connoisseur in clocks, watches and time-keeping mechanism. His genial disposition and evident delight in his subject made him an excellent demonstrator.

Mr. E. H. Horstmann.


## A Demonstration Visual Test

Dr. M. Luckiesh has sent us an ingenious novelty, devised by himself and Mr. Frank Moss, which takes the form of a pack of cards intended to serve as a "measuring stick" for seeing. The visual task consists in recognizing the capital letter formed by minute breaks in the series of parallel lines on the back of each card. Thirteen different letters are used. The time taken to recognize the complete series of letters is said to bear a direct relation to the illumination provided, e.g., an increase from 3 to 12 foot-candles was found to produce a 40 per cent. increase in "seeing power" thus defined. Such tests may be worth study, though they would seem to be much affected by the personal element. The writer has found, for instance, that, owing to his eyes being distinctly astigmatic, letters are extremely difficult to recognize with the cards in their normal upright position; it is also possible that the "jumping" of such patterns of lines to a somewhat liverish subject might render the test very trying. For these reasons fine dots on a uniform-toned background might be preferable. The front faces of the cards bear notes on "fundamental factors in vision," and these are printed on backgrounds of varying darkness, thus affording varying contrast with the type. These faces also may be used for purposes of experiment.

## A Scientifically Designed Illuminated Sign

A reader who has recently been examining the illuminated signs in Paris tells us that many of them give evidence of great ingenuity. An instance is afforded by an animated sign having at one end a couple of lively horses with a large pile of objects behind them. The rear horse kicks away in turn each of these objects, which, at the end of its luminous journey, breaks into a letter until the full name of the article advertised is revealed. This departure from traditional letter-forming devices is quite arresting and usually attracts a crowd. Our correspondent also mentioned a scientifically designed luminous fountain. Ordinary imitations of fountains are fairly successful but, as a rule, there is a sense of something missing. This impression, we were told, is due mainly to the fact that the luminous drops of water usually travel at a constant speed. The designer of the Paris sign has been to the trouble to design it on scientific principles, the trajectory of the water being exactly that which a fountain would actually display, whilst the speed of the moving water increases as it drops in accordance with the familiar dynamic law for falling objects. The result of this simple change is stated to be quite remarkable. The sign really resembles falling water traced in light.

## Train Lighting in Japan

We notice in the journal of the Electrotechnical Society of Waseda a contribution by Mr. N. Onodera describing the lighting of trains on the Imperial Government Railways in Japan. The article might be informative to British readers but for the fact that only the title appears in English, the remainder being in Japanese! The illustrations also suffer somewhat from the fact of being printed on rough mat paper. The usual methods of lighting appear to be based on the use of diffusing globes or hemispheres mounted direct on the ceiling, being thus in accordance with modern European methods.

## Festivals of Light in Italy

We have been favoured by a copy of an illustrated booklet recording the special lighting festivals organized in Italy in celebration of the fiftieth anniversary of the introduction of the electric incandescent lamp ("Light's Golden Jubilee"). The arrangements were made under the supervision of an influential committee formed on the instigation of Signor G. Motta (President of the Unione Nazionale Fascista Industrie Elettriche), on which Government Departments and learned and artistic bodies were represented. Displays were organized in a great number of Italian cities, and the booklet contains an imposing series of pictures of pleasing lighting effects. Special interest attaches to the floodlighting of the monument to Volta and the dignified memorial to him at Como. The lighting, from the inside, of the Colosseum at Rome, on which 140 kw. was expended, is also impressive. Many examples of floodlighting applied to celebrated churches are also shown. There are also some effective pictures of illuminated fountains.

## Window Lighting as a Decorative Element

The treatment of the lighting of the Cleveland Trust building, described by Mr. S. F. Strunk in *Light*, is unusual in several respects, notably in the use made of window-blinds illuminated from the inside. The building is situated at the intersection of two important streets. The bank officials were anxious to make the most of this good site, and to devise special means of attracting public notice to the building. Floodlighting naturally suggested itself, but the method was difficult to apply in the conventional way to this building, which is of classic design and has a dark exterior. Ultimately it was decided to turn the dark surface to advantage by using a luminous background and a silhouette effect. Modified floodlighting is effected by projectors mounted on the small balconies, which cause the columns to "stand out." But the most novel device is in the covering of windows with specially selected shade-material, having a light transmission factor of 18 per cent., which is strongly illuminated from within by floodlights. About 1,000 watts per window are used, and an illumination of about 100 foot-candles is provided. The equipment was mounted on the tops of tellers' cages and in other inconspicuous positions. The effect is quite striking, the long windows between the exterior columns forming a uniform bright background. Similar methods are applied to the arched windows, partially covered by ornamental ironwork, at the base of the building.

## Street Lighting in Melbourne

We note that Melbourne, like Sydney, has recently been reviewing its public lighting. The scheme in view deals with about eight miles of streets, and nearly 400 units of the ornamental decorative type are to be installed. One peculiar feature noted in Mr. Fallon's account of conditions in Sydney also applies to Melbourne—the existence of considerable lengths of street provided with verandahs, shading the pavement from the sun. In most cases lighting units can be attached by means of brackets, but in other instances poles have been passed through holes in the verandah roof.

# TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

*The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.*

## Modern Incandescent Lighting in Kinema Studios

By Mr. W. A. VILLIERS, B.Sc., A.C.G.I.

(*Paper read at the Meeting of the Illuminating Engineering Society held at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, London, W.C.2, at 6-30 p.m., on Tuesday, February 18th*, 1930.)

THERE have been many changes during recent years in the technique of film-making, and one of the greatest of these has been the change in methods of lighting the studio sets owing to the development of incandescent lighting for this purpose.

A very large amount of such development work has been accomplished in this country during the last few years, so that some of the British studios now have incandescent-lighting equipment which rivals anything else of the kind in existence.

A few years ago the kind of film that was used was only sensitive to light from the blue end of the spectrum, and was hardly affected by yellow or red light. It was therefore necessary to have a light source emitting rays of the higher frequencies, and arc lamps and mercury-vapour lamps were almost universally employed for lighting studio sets.

The advent of panchromatic film, however, did a great deal to alter the position. This film is sensitive to light from the whole of the visible spectrum, so that much truer colour rendering is obtained than with ordinary film stock; for instance, a light-red object which would appear black if taken with ordinary stock comes out in its natural tone on panchromatic film.

Since even panchromatic film is less sensitive to yellow-red light than to the higher frequencies, it is desirable, if correct colour values are to be obtained, to illuminate the object with light having a preponderance of yellow rays. Now, the ordinary carbon arc has few, and the mercury vapour practically none of these rays. It was found, however, that the light from incandescent gasfilled electric lamps run at certain efficiencies was of exactly the right kind for getting the truest colour rendering.

A further reason for using incandescent lighting became apparent when talking films were introduced, as it was found that the hum and noise from arc lamps made it very difficult to employ them in making talking films, even with the addition of an elaborate system of choking coils.

When incandescent lighting was used in film studios some additional advantages were found, the chief of these being:—

(1) Energy consumption is saved because more light is used where it is needed, and camera filters are unnecessary.
(2) There is less labour required in the operation of incandescent lamps.
(3) The lighting may be made more flexible.
(4) There are no fumes or smoke.
(5) There are no ultra-violet rays, which are injurious to the sight.
(6) The artists require very much less make-up, so that time is saved.

For descriptive purposes the lighting in a studio may be conveniently divided under five headings:—

1. General lighting.
2. Close-up lighting.
3. Spotlighting.
4. Sun lighting.
5. Special effects.

Each of these is a separate and distinct kind of lighting, achieved with a lighting unit designed for its one purpose only, but all of these kinds of lighting are generally used on any particular set.

*General lighting* consists of flooding the set with a diffused light of high intensity. This is usually effected by means of banks of lamps having a reflecting surface behind them. The number of lamps per bank varies in different designs from about six lamps to forty, and the wattage of each lamp from 200 to 1,500 watts.

At the present time it seems that 1,500 watts is gradually becoming the standardized size.

Various reflecting surfaces have been tried, including mirrored glass, different polished metals, such as stainless steel and chromium plate, various enamels, paints, etc.

At first, white-enamelled sheet steel was used to a considerable extent, as it forms a good and comparatively efficient surface for providing diffused light, and reflectors made in this manner are inexpensive. More recently, however, reflectors made of aluminium have come into prominence, as this material has the added advantage that it is very light, and such reflectors are easily manipulated in the studios.

The lamps are arranged in three or four rows, with separate fuses and switches for each row, so that the amount of illumination may be controlled.

In the largest models, which take about 18 kw., a blower is sometimes provided for removing the heated air, and thus keeping the holders and wiring cool.

Bank type reflectors are used suspended above the set, and, in some cases, are mounted on stands and used as broadsides.

In addition to these reflectors, a number of smaller units, often referred to as "domes," have been introduced for providing lighting in a set which cannot readily be lit entirely by large bank-type reflectors. These are also constructed of polished aluminium in various shapes, and are designed to accommodate smaller quantities of 1,500-watt lamps.

*Close-up Lighting.*

In making close-ups it is usual to have three or four lights placed near to the artist giving a diffused light. Various fittings have been tried with different numbers of lamps, but modern practice is to have single-lamp

units, as these are more mobile and flexible than multiple-lamp units.

The fitting most generally employed is a very simple one, and consists of an aluminium reflector mounted on a telescopic stand and equipped with one 1,500-watt gasfilled lamp. A diffuser is arranged in front of the lamp.

*Spotlighting.*

It is not possible to rely on general lighting alone when making films, as, if this were done, the photography would be quite flat and lifeless. It is necessary to produce high lights, shadows and modelling, and to accentuate certain features and characteristics. It is also desirable to provide back lighting, as this makes the players stand out in the picture and produces an artistic effect by outlining their features and hair with light. The lustrous golden hair of the film beauty is produced in this manner. The spotlight is the lighting unit which fulfils these functions.

In the early days attempts were made to use ordinary stage spotlights, but these did not give nearly sufficiently high intensity of light, so special cinema-studio spotlights were developed.

A very high intensity indeed is required, because the spotlight must be capable of casting deep shadows and causing bright high lights in a set which is already brilliantly illuminated by the general lighting.

Experiments have been made with many different optical systems, using innumerable kinds of lenses, mirrors and lamps, until a type has been developed which gives the best results for normal working, and is now most generally used. This is a spotlight equipped with a 3,000-watt gasfilled projector lamp in a cylindrical lamp house of about 18 inches diameter, with a silvered-glass parabolic mirror of special focus behind the lamp. The spotlight is made so that the beam of light may be directed at any angle, and the stand of the lamp is arranged so that when used on the floor of the studio the lamp may be raised or lowered.

It is possible to get wide or narrow angle beams by varying the focus of the lamp, and also to alter the diffusion, spread and intensity of the light by the use of three or four types of detachable interchangeable mirrors. Provision is made for diffusers in front of the lamp, the main purpose of these being to cut down the intensity of the light for certain special camera shots.

Another type of spotlight in general use is what is known as an "effect" spotlight. The purpose of this unit is to provide the highest possible spot intensity from the smallest practicable lamp house, as it is often desirable to conceal a spotlight in the middle of a set behind some object such as a chair, for picking out and emphasizing an important feature in the picture.

The conditions are therefore that the intensity shall be very high and that the spotlight shall be very small.

Under these conditions it is not feasible to use the same optical system as with the 3-kw. spotlight, because with a small lamp bulb and small parabolic mirror the proportion of the light which has to pass three times through the glass wall of the bulb at an acute angle becomes large, so that the efficiency would be low.

Instead of the parabolic mirror, therefore, a spherical mirror is employed behind the lamp, which reflects the light rays back on to the filament, these passing normally through the bulb. In front of the lamp is placed a special short-focus lens, which is thin and of low absorption. A 2-kw. lamp is used in the spotlight, the lamp house being approximately 9 inches in diameter.

*Sun Lighting.*

Sun lighting consists of the production in the set of a beam of light of very high intensity for such purposes as the representation of the sun's rays shining through a window; 5 and 10-kw. gasfilled lamps in suitable lamp houses are used for this purpose, and maximum beam-candle-powers of about four million candles are obtained.

The optical arrangements of the lamp house are somewhat similar to those of the 3-kw. spotlight, but further problems are introduced owing to the large power of the lamps and the amount of heat they produce. The effect of excessive heat is to increase the tendency towards blackening of the bulb, due to deposition of metal from the filament and its supports.

Various types of 10-kw. lamps have been developed with widely different characteristics. Some have been made with chimneys above the filament, into which the hot gas rises and is cooled. This method succeeds in its object, but is expensive and makes the lamps difficult to accommodate in a lamp house which has to direct a beam of light at various angles.

In other lamps the blackening is allowed to form, and tungsten powder is introduced into the bulb, so that when the lamp is inverted the blackening may be partially cleaned off by rinsing the powder round in the bulb. This method has found favour in America.

In some of the latest British projectors, which are probably the largest successful ones that have yet been constructed for incandescent lamps, the bulb is made comparatively large and is cooled by means of a silent air blower. It is also kept vertical with gearing for all positions of the projector.

This method has been found very successful in preventing troubles due to blackening, and obtaining reliable service from the lamps.

It is advisable to start up these large lamps through a resistance, which is cut out step by step, as otherwise the initial current is very high indeed, being of the order of 14 times full-load current, which would cause trouble by operating any protective gear in the circuit. One successful arrangement has been the use of a circuit breaker in conjunction with a resistance and an interlock, which makes it impossible to switch the lamps directly on to the mains without going through each step of the resistance.

*Effect Lighting.*

Incandescent lighting lends itself very readily to the production of special lighting effects in a set, as powerful incandescent lamps may be easily placed in positions where it would be difficult to accommodate other sources of illumination. Thus, a reading lamp on a table which would normally have, say, a 60-watt lamp, is equipped for filming purposes with a 500-watt projector lamp. Similarly other effects are obtained, such as a coal fire, by the use of projector lamps.

*Employment of Apparatus on the Set.*

For lighting the average set all the above apparatus is used, and is arranged somewhat as follows:—

Special bank-type fittings are slung overhead at an angle of about 30° with the horizontal, flooding light down on to the set for general lighting, and on the floor about a dozen single-light fittings providing a diffused light.

Running round the top of the set is a wooden beam, known as the spot-rail, and on this are clamped a quantity of 3-kw. spotlights, the number ranging from about 20 to 40 on a fair-size set. These are used for spotlighting and backlighting, and further 3-kw. spotlights are arranged on the floor for front and side lighting.

Effect spotlights which may be readily concealed amongst furniture or behind a door are placed close to the artists for modelling and for providing intense local lighting where it is required.

If the effect of daylight is needed, say, from a window, a sunlight spotlight equipped with a 10-kw. lamp is placed outside the set, and from 20 to 40 feet away from it, usually on top of a rostrum about 20 feet high.

The diameter of the spot of light is adjusted until it just covers the window.

The rostrum is used so that the light appears to come downwards from the direction of where the sun might be, and the shadows caused are realistic.

The lighting of a picture is thus made up of a lot of separate illuminations, provided by widely different types of incandescent light sources, and all those separate illuminations are blended together to form the lighted picture as seen on the screen.

## DISCUSSION

Mr. S. ROWSON (President of the Motion Picture Engineers' Association), in opening the discussion, expressed his appreciation of the interesting paper read by Mr. Villiers. The author had given an effective demonstration of the enormous candle-power available from modern incandescent units. This intense illumination was, however, apt to be inconvenient to artists owing to the great heat, which was sometimes so great that the grease and paint came rolling down the face. He believed that the reasons given by Mr. Villiers for the increasing tendency to adopt incandescent lamps were in the main correct, though it might be that in the future a return to arc lights might be witnessed. It was possible that the increasing use of incandescent lamps might be due, in a measure, to the fact that makers of arc lamps had not adapted themselves to the changing conditions in the film industry. An expert in America had told him that there had been little change in this field during the past 10 or 15 years, notwithstanding the improved and more complicated effects that were staged. One result of the successful introduction of incandescent lamps had been that a great deal of research had been applied to arc lights for use in studios. He understood that there were now coming into use in American studios new types of arc lamps, which might to some extent replace incandescent lamps. The latter were, however, advantageous when talking films were being made, owing to their noiselessness. It seemed likely that the next development in the production of such films would be the use of natural colour effects. This development might again favour the use of incandescent lamps, as the production of correct colours when using the arc light would be more difficult; there was a tendency to over-accentuate the blue end of the spectrum, but the improvements now being made in arc lamps might remove this disability.

Mr. W. A. BIGSWORTH (British Lion Film Studios Ltd.) said that he believed in the incandescent lamp for certain fields of work. He mentioned a recent picture which had required an expenditure of nearly 5 million watts in this form of lighting. Nevertheless, it had been stated in a paper recently presented in Toronto that in some cases arc lamps gave a better picture from the photographic standpoint, and there was a tendency to revert to arc lamps. Again, in certain cases good results would be obtained from combined lighting with both types of lamps.

Mr. HEATHCOTE (British and Dominions Film Corporation Ltd.) pointed out the great advantage of the arc lamp when it was desired to get a very distinct shadow. It was at present difficult to get very sharp shadows from an incandescent lamp. High intensity in itself was no advantage. Even with a 10 kw. lamp they could not expect to get such shadows, unless the area occupied by the filament could be diminished.

Mr. C. C. PATERSON remarked on the high illuminations necessary in instantaneous photography. Could Mr. Villiers state the approximate illumination in foot-candles that was considered necessary, both for the ordinary and the panchromatic film? It might be that when the latter type of film was used the illumination requisite would be less with incandesecnt lamps than if arc or mercury-vapour lamps were used. He congratulated Mr. Villiers on his interesting paper and on the lucid way in which he had conducted the demonstrations.

Mr. L. C. G. APPLEBEE remarked that one of the greatest difficulties in using arc lamps for talking films was the occasional spluttering. He described a method of control for arc lamps which he thought might be useful, and enquired whether this had been tried in kinema studio lighting. The arrangement gave a flat disc of light instead of a crater, which he thought would be an advantage.

Mr. L. E. BUCKELL referred to the paper read in Toronto mentioned by Mr. Bigsworth. He was not sure whether this represented the latest views of American experts on this subject. Possibly a modification of outlook might take place if the high stage now reached in practice with incandescent lamps were realized.

Mr. W. A. BIGSWORTH, referring to Mr. Applebee's remarks, said that the flat crater was not desirable for kinema studio work. A concave crater gave a better result. When positive soft-cored carbons were used, and the carbon was caused to revolve, a perfectly symmetrical crater could be obtained. He had himself been an instructor in arc lighting in the navy. At one time a very small crater was aimed at, but a crater of the type he described was now considered preferable. In regard to the use of arc lamps in getting natural colours, he might mention that specially cored "panchromatic" carbons were now available; these were cored with a material designed to correct any excess of light in the blue end of the spectrum.

Mr. S. G. DOUBLE (British International Pictures Ltd.) said that it was difficult to affirm that any one method of lighting was invariably the best in kinema studios. His personal impression was in favour of using incandescent lamps for top lighting and also for front lighting and side lighting, whereas for back lighting he preferred the arc. That was, however, a matter of opinion. The lighting conditions were determined primarily to meet the wishes of the camera man. At Elstree they had camera men of different nationalities, not infrequently holding different views. Experiments were being made at Elstree with chokers in the arc circuit in order to eliminate the "hum."

Mr. J. ECK said that, as an old arc-lighting man, he had been cheered by hearing that the arc lamp was coming back into its own again. It was true that the incandescent lamp had been marvellously improved, whereas until recently there had not been much opportunity for similar progress in arc lamps. He would, however, like to ask a few questions regarding one or two alleged disabilities of the arc. He could see no reason why arc lamps with panchromatic carbons should not be used quite satisfactorily for the production of natural colour effects. Artists suffered from the intense heat radiated from powerful incandescent lamps. The effect on the eyes had been associated with arc lamps but he thought there was no justification for this, as there was no such tendency with modern arc lamps for studio work. He believed that both forms of lamps had their advantages and could be used with good effect. In regard to intensities he believed that about 1,000 foot-candles was necessary for accentuation in studio lighting, and that the ratio between general illumination and "spot-illumination" was probably of the order of one to two. He would like to know the actual life of the powerful incandescent lamps now used for spot-lighting, and the extent to which the effective candle-power diminished during this life. He would also like to know how the illumination at the moment of "shooting" was determined. Did photometric apparatus form part of the equipment of a modern studio?

Mr. J. S. DOW, referring to Mr. Paterson's enquiry regarding the illuminations necessary in studios, mentioned that, in a recent discussion before the Illuminating Engineering Society (U.S.A.), some experiments in hospital operating theatres were described. For the taking of these educational films, about 1,500 foot-candles were required. The surgeons, it was said, found that this super-illumination enabled them to see more details than ever before, and resolved to adopt this illumination as a permanent feature. Allusion had been made to the great heat associated with these high illuminations. He thought that this might prove a factor of importance even in industrial and office lighting, when exceptionally high illuminations were provided. He understood that in the United States experiments had been made with water-cooling for exceptionally powerful incandescent lamps for studio work. An equally important matter, however, was the intense glare from high candle-power projectors. He found it difficult to imagine how artists could act naturally and preserve their expression with this intense

beam playing on their faces. He recalled a committee which was set up to enquire into eyesight troubles amongst artists. It was commonly assumed that this was due to ultra-violet light, but he thought that ophthalmologists would agree that intensely bright light alone was liable to cause eye trouble. Suitable screening would do much to diminish this trouble. He had held the impression that producers considered that well diffused light gave better results than intense lighting yielding harsh shadows, as seems to be accepted by photographic artists engaged in portraiture work. Recently, however, there had apparently been a tendency to revert to high contrasts and sharp shadow effects in films. He noticed that some of the overhead units shown by Mr. Villiers comprised numerous lamps assembled under a single reflector. He had seen units built up of a number of lamps, each in its own separate reflector; was there any advantage in this arrangement? In conclusion, Mr. Dow referred to the problem of noise caused by arcs used for talking films. He understood that the hum could now be got over by inserting a choker in the circuit, and that the most modern types of well-designed lamps were practically free from tendency to hiss and splutter. Unfortunately, users did not always adopt the best type of lamp, nor could one be certain of its being maintained in good condition, in which case spluttering might prove a source of difficulty.

Mr. WESTERN quoted some instances of companies who were now adopting arc lamps. Ever since the advent of talking films, there had been controversy regarding the relative merits of hard and soft lighting conditions. The tendency now seemed to be turning towards the use of hard light. He would like to hear further particulars of systems of chokers, some of which were somewhat elaborate, for eliminating ripples. He believed that in the States condensers had also been used for this purpose. Mr. Villiers had remarked that incandescent lamps gave out no ultra-violet rays, such as might be prejudicial to the eyes. Comparisons had been drawn between incandescent lamps and arc lights burning white flame carbons, but he thought it was correct to say that when panchromatic carbons were used there was no appreciable ultra-violet element such as could be considered detrimental to vision.

Mr. A. MACINERNY mentioned that he had recently witnessed in America the taking of important films entirely by the light of incandescent lamps. The recording range was apt to be limited by considerations of noise when arc lamps were used.

Mr. F. RISCH remarked that the inconvenience caused to artists by the great heat arising from intense illuminations was not confined to the melting of make-up. In some cases the throat and larynx had been affected, an important consideration in the case of talking films. The heat made artists very thirsty, and they drank water frequently, but rest and spraying the throat were sometimes necessary to relieve the vocal cords.

Mr. G. J. SHUTER remarked that almost every speaker had referred to the heat trouble. He could not help thinking that this was regarded from the wrong aspect. Radiant heat in itself was not unnatural; most people revelled in a "heat wave." Was it impossible to find make-up materials which did not soften and run?

Mr. SEWELL, referring to the remark of the last speaker, mentioned an experience of a leading artist, who had found it necessary to alter the whole nature of his make-up as a result of the adoption of incandescent lighting.

Mr. J. O. GIRDLESTONE, in a written communication, congratulated Mr. Villiers on his paper, though, as an arc lamp manufacturer, he entirely disagreed with him on certain points. Up to the time of the war, British studios were almost exclusively lighted by arc lamps. The enclosed type of arc lamp, burning singly on 200 volts or more, with a long arc of about two inches, gave a highly actinic light, with comparatively little heat. He believed that no other form of lighting could compete with this system. The illumination needed was not excessive, and as the enclosing glass cut off the ultra-violet rays there was no eye trouble. The advent of the panchromatic film, the entry of American producers with their own lighting methods, and the introduction of talking films had tended to discourage the use of arc lamps, and for a time the high candle-power incandescent lamp appeared to hold the field, in spite of the heat and relatively low actinic value. The objection to the use of enclosed arc lamps for work with panchromatic films was due simply to the use of unsuitable carbons. Carbons producing a light rich in violet-rays, used for ordinary films, were not suitable for panchromatic ones. But if carbons containing salts, yielding a reddish flame, were adopted, the results were excellent, and there was no reason why enclosed arc lamps of this type should not regain their position. The fundamental advantages of the arc lamp, the fact that the light did not deteriorate, the cost of upkeep was small, and the heating effects negligible, should not be forgotten. On direct current circuits the lamps were silent, the slight commutator ripple being, if necessary, blotted out by an inductive resistance or choking coil.

Mr. W. A. VILLIERS, in reply, said: In opening the discussion Mr. Rowson raised the question of the inconvenience of heat from incandescent lamps. In the early days this was certainly a source of annoyance, because the heat from incandescent lamps is largely radiant, and therefore affects the artists more than the conducted and convected heat from arc lamps.

Latterly, however, this problem has become much less acute for the following reasons:—

(1) There is a tendency to use much larger lens apertures, which means that less light is required and less heat produced.

(2) Searchlights are largely replacing bank-type illuminators on the floor; the spotlight produces more light in proportion to heat than the latter unit.

(3) There is now a fuller understanding of static ventilation.

(4) Faster film emulsions are now being made, which again reduce the amount of light required, and therefore also the heat.

(5) Research work is being actively carried out with a view to increasing the intensities of incandescent spotlights. These intensities will be materially improved in the near future.

(6) The use of heat-absorbing diffuser glasses. No practical water-cooled incandescent lamp has been made, and it is not considered that such a lamp is either possible or necessary.

It is interesting to learn that development work is proceeding in America on arc lamps; similar intensive work is, however, being conducted in this country on incandescent equipment.

Mr. Rowson, Mr. Bigsworth, Mr. Eck and Mr. Girdlestone all referred to the important question of colour. It is probable that there will shortly be a vogue of coloured films, and it seems that this development will favour incandescent lighting, which gives light of adequate intensity throughout the visible spectrum. It is possible to accentuate the red and yellow light from an arc lamp by adding various salts to the core of the carbon. Recent tests on the latest panchromatic carbons, however, show that even with these the light is distributed throughout the spectrum in a series of bands, certain regions of the spectrum being lacking.

In reply to Mr. Eck's enquiry, the average life of incandescent lamps is approximately 1,000 hours for general lighting lamps and 100 burning hours for spotlight lamps. The depreciation in candle-power during life is small, and owing to the absence of smoke or fumes the lenses and mirrors remain clean. The average lumens throughout life are over 90 per cent. of the initial lumens.

With regard to illumination provided in the set, a point touched upon by Mr. Paterson, it is not usual to employ photometers in the studio. The illumination varies greatly with different camera men, who judge the amount of light required by observation and past experience. Ordinary values would be 300 to 500 foot-candles for general lighting, and anything from 700 to 4,000 foot-candles for high lights.

Mr. Dow and Mr. Western referred to the possibility of eye trouble being caused by studio lamps. This has occurred in certain cases, and has been due to the ultra-violet rays emitted by the arc lamp. Such rays are not produced by the incandescent lamp, but are produced in the panchromatic arc. Glare is present with any form of high-intensity spotlight, but this does not appear to affect the artists adversely, and such glare is much less noticeable when there is also a lot of general lighting on the set.

The system mentioned by Mr. Dow of having separate reflectors for each lamp in general overhead fittings was the original method. The reason for using single reflectors for several lamps is that this method is cheaper and more robust, and there is no danger of patchiness.

Several speakers mentioned the matter of noise from arc lamps. This noise has two components, the hum caused by the commutators of the machine supplying the arc, and the hiss and splutter of the arc itself. The hum can be eliminated to a large extent by the use of chokers; these, however, have the disadvantage that they are bulky, heavy, and comparatively expensive. The hiss and splutter cannot at present be conveniently prevented, and, if a bad splutter occurs during a camera shot, a retake becomes necessary. In any case, as mentioned by Mr. MacInerny, the recording range is limited when arcs are employed.

I hope that the above covers all the important points raised by the various speakers.

---

# National Illumination Committee of Great Britain

*(Affiliated to the International Commission on Illumination)*

## Representatives Nominated by the Constituent Associations of the Committee :—

BY THE CONTRIBUTING ASSOCIATIONS :—

*Illuminating Engineering Society:*
H. BUCKLEY
J. S. DOW
DR. A. H. LEVY
C. C. PATERSON
A. P. TROTTER.

*Institution of Gas Engineers:*
F. G. GORMAN
W. J. A. BUTTERFIELD
CAPT. W. J. LIBERTY
H. E. COPP
R. WATSON.

*Institution of Electrical Engineers:*
P. GOOD
LT.-COL. K. EDGCUMBE
H. T. HARRISON
PROFESSOR J. T. MACGREGOR MORRIS
J. M. G. TREZISE.

*National Physical Laboratory:*
SIR J. E. PETAVEL
DR. J. W. T. WALSH.

BY THE CO-OPERATING ASSOCIATIONS :—

*Air Ministry:*
MAJOR R. H. S. MEALING
CAPT. T. KERR-JONES.

*Association of Public Lighting Engineers:*
E. J. STEWART.

*British Commercial Gas Association:*
C. F. BOTLEY.

*British Electrical and Allied Manufacturers' Association:*
G. CAMPBELL
T. E. RITCHIE.

*British Electrical Development Association:*
COL. W. A. VIGNOLES.

*Electric Lamp Manufacturers' Association:*
W. J. JONES
C. W. SULLY.

*General Post Office:*
MAJOR H. C. GUNTON.

*His Majesty's Office of Works:*
J. A. MACINTYRE.

*Home Office:*
D. R. WILSON.

*Incorporated Municipal Electrical Association:*
A. J. FULLER.

*Institution of Municipal and County Engineers:*
J. SUTCLIFFE.

*Medical Research Council:*
DR. H. HARTRIDGE.

*Ministry of Health:*
A. SCOTT.

*Ministry of Transport:*
E. S. PERRIN.

*National Gas Council:*
R. WATSON.

*Railway Clearing House:*
W. C. GOODCHILD
MAJOR G. H. SPITTLE.

*Society of British Gas Industries:*
F. J. GOULD
COL. E. WILSON.

*Society of Glass Technology:*
B. P. DUDDING.

The Committee has made the following appointments :—

*Representatives of Great Britain on the Executive Committee of the International Commission on Illumination:—*

P. GOOD, R. WATSON and (ex-officio) LT.-COL. K. EDGCUMBE.

### OFFICERS:

*Chairman:* LT.-COL. K. EDGCUMBE.

*Vice-Chairmen:* C. C. PATERSON and R. WATSON.

*Hon. Treasurer:* W. J. A. BUTTERFIELD, 66, Victoria Street, London, S.W.1.

*Hon. Secretary:* H. BUCKLEY, The National Physical Laboratory, Teddington, Middlesex.

# National Illumination Committee of Great Britain

## Chairman's Report for the year 1929, presented at the Annual Special Meeting on Thursday, 30th January, 1930

IT was with deep regret that the Committee learned of the death of Signor G. Semenza on the 7th November, 1929. He was for many years a vice-president of the International Commission on Illumination and had always taken a great interest in its proceedings. His loss is deeply deplored by members of the Committee in common with the whole of the scientific world.

The principal activities of the Committee during the past year have been in connection with the carrying-out of the programme of work decided upon by the International Commission on Illumination at its Bellagio and Saranac meetings, and with the preliminary preparations for the 1931 meeting of the Commission, which is to be held in England.

As recorded in last year's annual report the National Committee has appointed a number of sub-committees to deal with the subjects of which the Commission is making a special study, for five of which the British Committee has accepted the secretariat responsibility. Responsibility for the other subjects is divided among the other countries which are members of the Commission. In connection with most of these subjects the British sub-committees are in fairly close touch with their corresponding sub-committees abroad. In a few cases the contact is not so good. The British sub-committees are all at work, and it is hoped that fuller co-operation will now be secured and that the imminence of the 1931 meeting will result in more intensive efforts in all countries.

The progress made in each subject since the Saranac meeting in 1928, together with the names of members of the British sub-committees, is given below:—

I. SUB-COMMITTEES ON SUBJECTS FOR WHICH THE SECRETARIAT RESPONSIBILITY IS HELD BY GREAT BRITAIN.

*No. 7. Coloured Glass for Signal Purposes.*
*Members*:—

Dr. E. H. RAYNER (Chairman)
Mr. B. P. DUDDING — Dr. W. M. HAMPTON
Mr. J. GUILD — Major L. H. PETER
Mr. H. BUCKLEY (Secretary).

This committee is endeavouring to standardize the methods of specification and testing of Coloured Signal Glasses used for transport and traffic purposes of all kinds. At the 1928 meeting of the Commission it was agreed internationally that the specification of such glasses should be on a colorimetric basis. As the particular basis which should be adopted is almost entirely a matter for experts in colorimetry, the Colorimetry Sub-committee has been asked to advise. The reply from this sub-committee is awaited with interest, and it is hoped that it will be available in the near future. Information has been requested from co-operating experts in other countries in connection with colour and intensity requirements for signal purposes. It is understood that modification of the existing standards is now being considered in three countries, and information with regard to this is being sought.

*No. 7a. Traffic-Control Signals.*
*Members*:—

Mr. L. B. W. JOLLEY (Chairman)
Mr. H. BUCKLEY — Mr. F. L. CASTLE
Mr. J. E. COLQUHOUN — Dr. W. M. HAMPTON
Mr. J. W. JONES — Mr. G. S. WOOTTON
Mr. J. S. PRESTON (Secretary).

This subject was initiated at the 1928 meeting of the Commission. The sub-committee is endeavouring to secure information relative to traffic-control practice in a number of countries. To this end a questionnaire has been prepared and sent to co-operating experts in foreign countries. When the replies are received the sub-committee will be able to prepare a report on current practice for international consideration.

*No. 12. Daylight Illumination.*
*Members*:—

Mr. J. MACINTYRE (Chairman)
Mr. A. MUNBY — Mr. A. SCOTT
Dr. R. UNWIN — Mr. P. J WALDRAM
Dr. J. W. T. WALSH — Mr. J. G. WEST
Mr. H. BUCKLEY (Secretary).

The penetration of daylight into interiors is being studied by this sub-committee. International agreement was obtained in 1928 on the method of defining the daylight illumination at points in rooms—the daylight ratio, and on a standard sky brightness representing the worst exterior daylight conditions which should not require the use of artificial lighting.

The problem of deciding what is adequate daylight illumination in circumstances not requiring special acuity of vision is now being considered. Information on this problem has been requested from the foreign experts, and it is hoped that their replies will be available in the near future. The British sub-committee are awaiting the forthcoming publication of a report on this question which is being prepared by the Illumination Research Committee of the Department of Scientific and Industrial Research.

Meanwhile progress is being attempted in two other directions:—

(1) The simplification of the methods of determining daylight ratios.
(2) The definition of reasonable proportions for windows in connection with permissible exterior obstructions.

As regards the former a mechanical integrator has been developed which gives promise of success, and as regards the latter efforts are being made to obtain the opinion of architects.

*No. 15. Colorimetry.*
*Members*:—

Mr. T. SMITH (Chairman)
Dr. S. G. BARKER — Mr. J. GUILD
Dr. W. M. HAMPTON — Dr. L. A. JORDAN
Dr. R. LYTHGOE — Dr. L. C. MARTIN
Mr. J. W. RYDE — Dr. W. CLARK
Mr. H. BUCKLEY (Secretary).

This subject was initiated at the 1928 meeting. The object of the sub-committee is to place colour measurements and terminology on an agreed international basis. As an initial step it has prepared and circulated to foreign experts a statement of the present status of two practical proposals for a standard illuminant. Criticisms have been received from two countries and are under consideration by the sub-committee. The question of a standard nomenclature is being discussed, and a set of suitable definitions is being prepared for submission to co-operating experts.

*No.* 18. *Lighting Education.*
*Members*:—

Professor J. T. MACGREGOR MORRIS (Chairman)

| | |
|---|---|
| Mr. H. BUCKLEY | Mr. W. E. BUSH |
| Dr. F. T. CHAPMAN | Mr. J. S. DOW |
| Mr. F. W. GOODENOUGH | Mr. C. E. GREENSLADE |
| Mr. J. W. JONES | Mr. W. MASON |

Mr. C. J. W. GRIEVESON (Secretary).

The subject of Lighting Education was initiated at the 1928 meeting after discussion of a report on the present state of the subject which was prepared by the United States National Committee. The British sub-committee have requested information from those countries which did not contribute to that report. They have also proposed the preparation of a handbook on Photometry and Illumination which would serve to supplement the available textbooks on Optics in secondary and junior technical schools. Members of the sub-committee have discussed the method of preparation of such a handbook with a sub-committee of the Illuminating Engineering Society, when it was decided that they should report to their respective organizations in favour of the proposal.

II. SUB-COMMITTEES ON SUBJECTS FOR WHICH THE SECRETARIAT RESPONSIBILITY IS HELD BY OTHER COUNTRIES.

*Nos.* 1 *and* 2. *Definitions and Symbols, and Vocabulary.*
*Members*:—

Dr. J. W. T. WALSH (Chairman)

| | |
|---|---|
| Mr. H. BUCKLEY | Mr. B. P. DUDDING |
| Mr. P. GOOD. | |

The above members form Technical Committee (2) of the Illumination Section of the British Engineering Standards Association, which acts on behalf of the British National Committee as regards international work. It has agreed to proposals for the adoption of the C.G.S. system in connection with photometric quantities, and has considered a number of definitions of terms used in the specification of the properties of diffusing materials in consultation with the sub-committee dealing with diffusing materials.

*No.* 3. *Automobile Headlights.*
*Members*:—

Lt. Col. K. EDGCUMBE (Chairman)

| | |
|---|---|
| Mr. P. GOOD | Mr. O. LUCAS |
| Mr. F. NEWTON | Mr. E. S. PERRIN |
| Mr. POWELL | Dr. W. S. STILES |

Mr. L. B. W. JOLLEY (Secretary).

The sub-committee are awaiting the results of some experiments undertaken by the Department of Scientific and Industrial Research on the subject of Glare, since it is felt that in the absence of more precise knowledge of the conditions affecting glare in headlights little further progress can be made.

*Nos.* 4 *and* 14. *Factory and School Lighting and Cinema Lighting.*
*Members*:—

Mr. D. R. WILSON (Chairman)

| | |
|---|---|
| Mr. G. CAMPBELL | Mr. J. S. DOW |
| Major H. C. GUNTON | Mr. J. M. HENSHAW |
| Mr. W. J. JONES | Mr. W. MASON |
| Mr. T. E. RITCHIE | Mr. P. H. SUGG |

Mr. H. C. WESTON (Secretary).

The report of the International Committee on Factory and School Lighting presented at the 1928 meeting of the Commission has been considered, with special reference to the method of grading light sources in respect of glare as proposed by the American Committee. The sub-committee has had the opportunity of discussing with two factory inspectors, who have attended a meeting of the sub-committee, the desirable measurements of illumination in factories which it is recommended that visiting factory inspectors should make. Information relating to modern practice in office lighting is also being collected.

*Nos.* 5 *and* 10. *Heterochromatic Photometry. Photometric Test Plates and Photometric Precision.*
*Members*:—

Professor J. T. MACGREGOR MORRIS (Chairman)

| | |
|---|---|
| Mr. B. P. DUDDING | Mr. H. BUCKLEY |
| Mr. J. S. DOW. | |

Reports are in preparation by members of this sub-committee in which data will be presented giving statistical information on the precision attained in a number of heterochromatic photometric observations, covering a wide range of colour difference. The sub-committee is also considering the organization of a test to determine how closely individuals and organizations using portable photometers agree among themselves in the measurement of illumination.

*No.* 6. *Street Lighting.*
*Members*:—

Mr. C. C. PATERSON (Chairman)

| | |
|---|---|
| Mr. G. H. BAILLIE | Mr. J. F. COLQUHOUN |
| Capt. J. M. DONALDSON | Col. K. EDGCUMBE |
| Mr. F. J. GOULD | Mr. H. GUNNER |
| Mr. H. T. HARRISON | Mr. L. B. W. JOLLEY |
| Mr. J. W. JONES | Mr. T. H. KINGHAM |
| Mr. F. NEWTON | Mr. E. S. PERRIN |
| Mr. T. E. RITCHIE | Mr. E. J. STEWART |
| Mr. E. STROUD | Mr. P. H. SUGG |
| Mr. J. TERRACE | Mr. C. W. SULLY |
| Mr. R. WATSON | Dr. J. W. T. WALSH |
| Col. E. A. WILSON | Mr. E. WILLIS |

The Sub-committee on Street Lighting has been actively engaged in the revision of the Street Lighting Specification (British Standard Specification No. 307-1927). The demonstration given in Sheffield in 1927 of the installations designed to illustrate the various methods of complying with the specification showed that the specification came through the test very creditably, although it indicated one or two points on which modifications were necessary. It is these points that the sub-committee is now looking into, so that it may be prepared to put forward its latest considerations at the 1931 meeting. As a result of the meeting held in America last year, the sub-committee is considering the inclusion of "average" as well as "minimum" illumination in the specification.

*No.* 8. *Diffusing Materials.*
*Members*:—

Mr. H. BUCKLEY (Chairman)

| | |
|---|---|
| Dr. S. ENGLISH | Dr. W. M. HAMPTON |
| Mr. L. B. W. JOLLEY | Mr. J. W. JONES |
| Mr. J. S. PRESTON | Mr. P. H. SUGG |
| Mr. J. M. WALDRAM | Mr. J. W. RYDE. |

The above members form a panel of the British Engineering Standards Association Technical Committee 3, dealing with Lighting Fittings, which is acting on behalf of the British National Committee for this subject. Meetings of the panel have discussed several reports from the National Physical Laboratory dealing with the reflection and transmission characteristics of a series of 8 in. opal spheres, all made from the same melt of glass and covering a wide range of thickness.

A copy of a proposed programme of work has been sent to the German Secretariat Committee for circulation to co-operating experts, and their criticisms are awaited. The sub-committee is also considering a number of questions which have been asked by the German Secretariat Committee.

*No.* 11 *Classification of Light Distributions.*
*Members*:—

Mr. H. BUCKLEY (Chairman)

| | |
|---|---|
| Major J. W. BUCKLEY | Mr. G. CAMPBELL |
| Dr. S. ENGLISH | Mr. W. C. GOODCHILD |
| Mr. T. H. HARRISON | Mr. H. E. HUGHES |
| Mr. L. B. W. JOLLEY | Mr. T. E. RITCHIE |
| Mr. E. STROUD | Mr. P. H. SUGG |
| Mr. G. WILSON. | Dr. J. W. T. WALSH. |

The above members form a panel of the British

Engineering Standards Association Technical Committee 3, dealing with Lighting Fittings, which is acting on behalf of the British National Committee for this subject. The panel has prepared answers to the questionnaire drawn up on this subject at the 1928 meeting. A method of classifying light distribution has been proposed for international consideration. This classification first divides distribution into four main classes, based on the amounts of flux in the upper and lower hemispheres. These types are then further classified according to the shape of their polar curves. In effect the classification defines:—

(1) Direct distribution, semi-indirect distribution, etc.,

(2) Narrow distribution, wide distribution, etc.

The panel has also considered proposals made by the Belgian Secretariat Committee with regard to the use of polar diagrams of light distribution, and has commenced the study of asymmetric light distributions.

*No. 16. Applied Lighting Practice.*

*Members*:—

Mr. J. W. JONES (Chairman)

Mr. G. CAMPBELL — Mr. H. LONG
Mr. T. E. RITCHIE — Mr. E. J. STEWART
Major G. H. SPITTLE.

This sub-committee is making a study of Applied Lighting Practice, with special reference to the collection of data on modern installations, with the object of establishing those qualities which constitute good lighting. Reports are being prepared on Railway Lighting, Sports Lighting, Illuminated Advertising, Shop Lighting and Floodlighting.

*No. 17. Aviation Lighting.*

*Members*:—

Major R. H. S. MEALING (Chairman)

Mr. H. BUCKLEY — Mr. H. N. GREEN
Dr. W. M. HAMPTON — Mr. L. B. W. JOLLEY
Capt. T. KERR-JONES — Mr. H. LINGARD
Mr. H. MARRYAT — Major R. H. MAYO
Mr. T. E. RITCHIE — Capt. C. E. WARD
Mr. A. G. WATSON.

This sub-committee is studying ground lighting in connection with aerodromes and air routes. At an informal meeting with foreign representatives, held in July last in London, it was decided to recommend to the International Commission on Illumination that an attempt should be made to bring about international standardization of voltages and lamp dimensions for aircraft purposes. This aspect will be dealt with by a committee of the Aircraft Section of the British Engineering Standards Association. The Conference also recommended that the co-operation of the International Air Traffic Association be secured. This has been done and a representative of the Commission will be invited to attend future meetings of the Association.

Early in November proposals were received from Holland and Germany that a meeting of delegates of all the Aviation Lighting Sub-committees associated with the International Commission on Illumination should be held in Berlin in February. The British sub-committee agreed to co-operate and suggested an agenda dealing with fundamental aspects rather than details. In consequence the sub-committee is preparing a statement dealing with the definition and fundamental requirements of the more important lighting equipment required for aerodromes and air routes.

*International Illumination Congress* (1931).

Preparations for the 1931 meeting of the International Commission on Illumination, which is being held in Great Britain at the invitation of the British Committee, were begun early in the year. It was decided that the meeting of the Commission should be associated with an International Illumination Congress, which would visit a number of places of interest to illuminating engineers where papers would be presented and discussions held.

The Illuminating Engineering Society has agreed to co-operate with the National Committee in the organization of the Congress, and an executive committee consisting of members of the two organizations has been set up to deal with all matters relative to the Congress as well as the non-technical portion of the meeting of the Commission at Cambridge. The technical aspects of this meeting will, of course, be directly under the control of the Central Bureau and the Executive Committee of the Commission.

Colonel C. H. Silvester Evans has kindly consented to act as Honorary Secretary to the Congress. Sub-committees have been appointed to deal with finance, publicity, entertainments, papers, etc., and are now busy with detail work. It has also been decided that the meeting of the International Commission on Illumination itself should be held at Cambridge.

The committee has been strengthened during the past year by the appointment of representatives of the Air Ministry, the British Commercial Gas Association, the British Electrical Development Association and the Incorporated Municipal Electrical Association.

The Committee is very grateful to its members and also to those non-members who serve on its various sub-committees, for the ungrudging assistance they have given during the past year. The Committee sincerely hopes for the continuance of their assistance in the coming year, since upon it will depend very largely the part Great Britain is to play in the forthcoming 1931 meeting.

K. EDGCUMBE,
*January 30th*, 1930. *Chairman.*

# Report of the Illumination Section of the British Engineering Standards Association for 1929

## Prepared for the National Illumination Committee of Great Britain

THE Illumination Section has again been very active this year, in preparation for the 1931 meeting of the International Commission on Illumination, as it is realized that if the meeting is to be a success from the British point of view the British committee must go well equipped to take an active part in the discussions.

Due to incorporation by Royal Charter, a certain amount of reorganization has taken place within the Association. The work is now divided into Industry Sections. Each section consists of:—

(1) An Industry Committee which is responsible, under the direction of the Council, for the work of the Association in so far as its particular section is concerned.

(2) Such Technical Committees as are necessary to assist the Industry Committee in carrying out its work.

(3) Any contributing members of the Association who are definitely interested in that particular section.

Under the Charter and By-laws, a meeting of the whole section has to be held once a year, at which three members are elected to the Council of the Association to represent that section.

A meeting of the Illumination Section was held in October, 1929, at which Colonel Edgcumbe, Mr. F. W. Goodenough and Mr. C. C. Paterson were elected to represent the Illumination Industry Section on the Council. At that meeting a proposal was also made that the question of artificial-daylight units should be investigated, with a view to classification and standardization.

*Technical Committee* 2, *Nomenclature and Definitions*, is acting as a sub-committee for the National Illumination Committee on this subject, and in this capacity has agreed to the use of the C.G.S. system, and has also drawn up, in consultation with a sub-committee on diffusing materials, certain terms and definitions relating to these materials.

*Technical Committee* 3. *Lighting Fittings.* The principal work of this committee during the past year has been the preparation of a method of describing the performance of lighting fittings. This has taken some time to prepare, as considerable difficulties presented themselves, but the committee has now prepared what it feels to be a very satisfactory report. This has been sent forward not only to the National Illumination Committee for transmission to the other national committees, but it has also been presented to the Illumination Industry Committee for issue as a British standard.

The Lighting Fittings Committee is also carrying out a series of investigations in connection with diffusing materials, which work is also principally for the National Illumination Committee.

*Technical Committee* 5. *Street Lighting.* This committee is revising British Standard Specification No. 307, in the light of experience gained very largely through the demonstration which was carried out at Sheffield in 1928. As a result of the meetings held in America last year, it is also considering the inclusion of average as well as minimum illumination in the specification.

*Technical Committee* 6. *Electric Lamps.* In view of the continual progress which is being made in the manufacture of electric lamps, it has been agreed to review this specification each year, and a further revision is on the point of completion.

*Technical Committee* 8. *Components of Optical Projection Apparatus.* The draft specification for the components of optical projection apparatus has just been completed, and submitted to the Industry Committee for approval.

## Light Beacons for Night Flying

An informative contribution on the above subject by Dr. W. M. Hampton has recently appeared*. It is remarked that the visibility of any light source depends mainly on three considerations: (1) the equivalent candle-power of the light source in the direction of the observer, (2) the distance between the light source and the observer, and (3) the state of transparency of the atmosphere. It is now generally accepted that 0.37 candles can be seen at a distance of one mile by normal observers in fine weather, but in order to allow for various disturbing influences (e.g., glint from propellers, wet or dirty goggles, or travelling at a high speed), an increase of $33\frac{1}{3}$ per cent., giving a standard of 0.5 candles at a distance of 1 mile in clear weather, may preferably be assumed. In clear weather the intensity of the light for a constant visibility should be proportional to the square of the distance.

Unfortunately the atmosphere is in practice never quite clear and absorbtion enters into the problem to some extent. Its effect may be expressed in the formula: —

$$I_0 = \frac{0.5\, x^2}{t^x}$$

where $I_0$ is the required intensity in the direction of the observer, $t$ is the transmission per mile of atmosphere, and $x$ the distance between the light source and the observer in miles. The effect of atmospheric absorption under varying atmospheric conditions is illustrated by the following figures:

when $t = 1.00$ $I_0 = 50$
$t = 1.85$ $I_0 = 253$
$t = 0.50$ $I_0 = 51{,}200$
$t = 0.10$ $I_0 = 500{,}000{,}000{,}000$

There remains the question of colour. In general a mist or fog scatters the blue end of the spectrum more than the red, with the result that distant lights assume a reddish hue. Hence a source emitting mainly red and orange light will be less affected in colour by distance and will be less reduced in intensity. This explains why neon beacons are said to have special virtues as fog-penetrators. The following comparison between neon light and a gasfilled lamp is of interest: —

| Distance in miles | Relative Intensity (under Conditions as Curve II) Neon | Gasfilled lamp. |
|---|---|---|
| 0 | 100 | 400 |
| 1 | 35 | 120 |
| 2 | 12 | 37 |
| 3 | 4.5 | 12 |
| 5 | 0.52 | 1.04 |
| 10 | 0.0027 | 0.0035 |

It is evident that both lights tend to have the same intensity at great distances, when the white light is the more powerful at the shorter ranges.

It must be remembered, however, that the neon tube does not lend itself to concentration, whereas the gasfilled lamp does, and that by using a suitable red filter light from the latter may be rendered indistinguishable from light from the former. Such a filter-lens combination gives about 4 to 5 candles per watt as compared with 15 to 20 candles per watt for an unscreened lamp and lens. Neon lamps yield about 1 to $1\frac{1}{4}$ horizontal candles per watt, so that the incandescent lamp with lens, even if used with a filter, may be more economical than the neon light.

In conclusion, the author quotes some conclusions arrived at by Messrs. F. Chapin Breckenbridge and J. E. Nolan* of the Bureau of Standards U.S.A., which are as follows:

"We conclude that there is no difference, sufficiently great to be found by the methods of this test, between the visibility of light from a neon lamp and light of the same colour and horizontal candle-power distribution from an incandescent lamp.

"With regard to the comparison of the clear and red beams, the results of the test admit of no doubt. The addition of the red filter does not increase the range of a clear beam under any weather conditions. It was, however, noticed that the red and neon flashes were generally easier to find among the shore lights, especially before the observers had learned just where to look for the beacon.

"These conclusions applied to the problem of beacon design suggest that the neon lamp must be compared with the combination of incandescent lamp and colour filter entirely on the basis of performance at the beacon."

* *Aircraft Engineering*, March, 1930, p. 64.

* F. Chapin Breckenbridge and J. E. Nolan. "Relative Visibility of Luminous Flashes from Neon Lamps and from Incandescent Lamps with and without Red Filters." Research Paper 78, July, 1929.

## The Lighting of Textile Mills

At a meeting of the Illuminating Engineering Society held in the lecture theatre of the Home Office Industrial Museum (Horseferry Road, Westminster, S.W.1) on March 25th, an informative paper on "The Lighting of Textile Mills" was presented by Mr. S. Anderson. As usual members assembled at 6-30 p.m. for light refreshments, and the chair was taken by the President (Dr. John W. T. Walsh) at 7 p.m.

Mr. Anderson dealt with his subject in a very informative manner, pointing out the magnitude of the industry and the large numbers of workers employed. The paper was illustrated by numerous lantern slides showing the special lighting requirements of the various processes.

At the conclusion of the meeting the President announced that the next meeting would take place on May 6th, when a paper would be read by Mr. T. Austin on "Luminous Traffic Signals."

Mr. Anderson's paper and the ensuing discussion will appear in our next number.

# Modern Railway Lighting

A LECTURE dealing with the aims and methods of railway lighting was given by Mr. A. Cunnington before the Southern Railway Debating Society recently. In dealing with the aims of railway lighting, it was pointed out that in addition to the primary one of facilitating the operation of the railway after dark, considerable importance is now attached to the publicity value of good lighting, and also illumination plays an important part in increasing the revenue from trade advertisements by making them effective at night. In the course of the lecture the two primary laws of illumination were referred to, and their application was outlined in the case of platform lighting and in relation to the lighting of nameboards or posters. The use of the K-Ray system for the latter purpose was demonstrated.

The importance of control in lighting was stressed, and the use of control switches for gas lighting as well as for electric lighting was explained. Control is of special importance on railways because of the wide periods, especially in country districts, during which the lighting is not required for operating purposes, so that economies can be effected by proper control without in any way detracting from the efficiency of the lighting in use when traffic is being dealt with.

Reference was made in the paper to one or two special problems such as the screening of lights in a signal box in order to facilitate the view of the signalmen when looking out through the windows, and in dealing with shunting yards the lecturer indicated the importance of illumination in the vertical plane as showing up the ends of moving vehicles and labels, etc., on the sides of waggons. Illustrations were shown of the use of projectors on high masts in shunting yards and carriage sidings, and it was mentioned that developments are likely to take place rapidly in this direction. Some of the difficulties of office lighting were also mentioned, those particularly relating to railway work being the glare from glazed paper and use of coloured invoice sheets, etc. The lecturer also mentioned the great difficulty of combating the dust nuisance, and keeping fittings clean without undue expense in labour.

The lecture was concluded with a number of lantern slides showing examples of modern railway lighting on the Southern Railway, the Underground Railway and some railways abroad.

By the courtesy of Mr. Cunnington we have received several photographs of recent lighting installations on the Southern Railway, as shown in Figs. 1 to 3. All of these illustrate novel and distinctive methods.

Fig. 1 shows the booking hall at Wimbledon Station, which is illuminated by fittings of the box type specially selected by the architect in order to harmonize with the general lines of the architecture of the station. One of these units is seen in the left-hand top corner of the illustration. They are composed of rippled glass encased in metal angle framing and suspended close to the ceiling. The brackets round the wall are provided mainly for decorative effect and add little to the general illumination. Attention may also be drawn to the panels round the wall, which are equipped with K-Ray fittings. These are applied either to illuminate posters advertising the company's services or, alternatively, as showcases for exhibiting the wares of local tradesmen.

Fig. 2 shows the Epsom Station front, which is floodlighted by means of lamps concealed in trough-reflectors above the fascia. The lettering of the fascia is also illuminated from behind, and the downward light from these sources is used to illuminate the pavement below.

The final illustration (Fig. 3) shows the latest type of illuminated nameboard as introduced at Sutton Common. In this case the end pieces and top capping

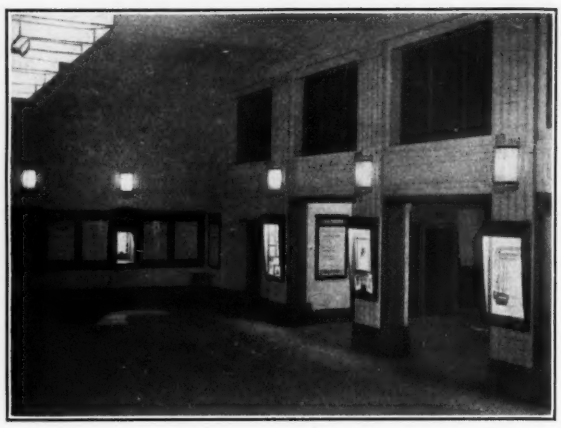


FIG. 1.—A view of Wimbledon booking hall, showing lighting by overhead box-unit supplemented by brackets for decorative effect.

are of concrete, and the posts carry two plate-glass fascia boards, with a space of about 9 ins., between them in which two or three small candle-power lamps are inserted. The effect of this internal illumination is satisfactory, without any very great degree of brightness being attained, and the system is economical both in regard to cost of current and maintenance.

The platform standards at the new stations on the Wimbledon and Sutton line are also of unusual design,

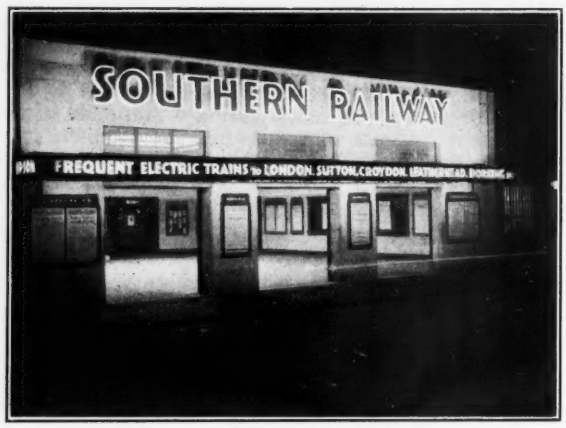



FIG. 2.—Epsom station front, showing floodlighting of frontage from concealed troughs above the fascia.

though this is not revealed in the photograph. These standards consist of large opal spheres, with the name of the station fired on the glass in black lettering. It will be noted that a fairly uniform illumination is provided on the platform surface, and the general effect is quite pleasing.

FIG. 3.—Sutton Common Station, where the latest pattern of illuminated nameboard has been installed.

# POPULAR & TRADE SECTION

COMPRISING

**Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers**

*(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society and is based on outside contributions.)*

## An Electrical Spectacle at Charing Cross

*(Communicated by the E.L.M.A. Lighting Service Bureau.)*

NO Illuminating Engineer should miss the opportunity of seeing the Modern Lighting Exhibit which is on display during the month of March at the Charing Cross Underground Station. It is situated in the booking hall where other famous exhibits, including Segrave's " Miss England " and the Signalling Exhibit, have recently been on view.

As with all previous exhibits, the Underground Company have arranged that this display shall be distinctly educational, and it certainly fulfils this function admirably, which is not surprising in view of the fact that the E.L.M.A. Lighting Service Bureau and the British Electrical Development Association collaborated in the work.

The stand itself is divided into three interiors with the addition of two built-in windows, and a considerable amount of exterior lighting is provided by various luminous features in the form of flashing opal cubes, lamp pylons, etc.

Perhaps the most striking interior is the lounge, which has been designed entirely on architectural lighting lines, and will undoubtedly be a revelation to the many thousands who will see this exhibit. Its object is to illustrate the possibilities of "furnishing with light," and it is undoubtedly a fascinating demonstration.

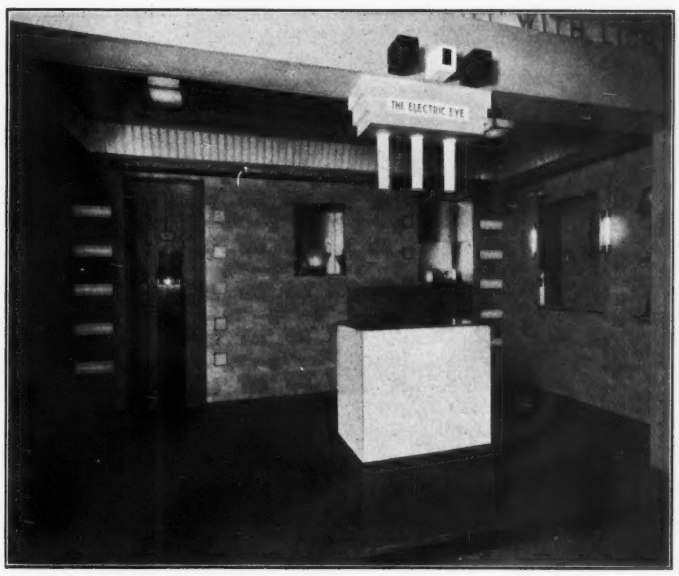



FIG. 1.—A View of the Demonstration Room.

FIG. 2.—A View of the Lounge.

What has been called the demonstration room, situated on the opposite side to the lounge, presents many outstanding features which will undoubtedly exert a considerable influence on the public mind and react favourably to the benefit of the electrical industry.

Perhaps the most ingenious demonstration in this room is the three-colour cornice lighting, controlled by three photo-electric cells which can be operated by members of the public placing their hands over apertures in a front pedestal. Each beam of light interrupted in this manner brings on one colour of lighting in the cornice, and the combinations of colours obtained in this manner by the use of red, green and blue lamps produce remarkably pleasing effects. This particular demonstration is appropriately entitled " Controlling Light with Light "—" The Electric Eye."

Other features of this room will not fail to attract attention, since the majority of effects are unique in character and educational in nature. These exhibits include a novel system of indirect ceiling lighting, two remarkable colour lighting recesses, a mirror lighting demonstration, and one of the familiar Lighting Service Bureau lamp cabinets.

The " House You Want " sign, recessed into one of the walls of the stand, is eminently instructive and an excellent piece of development propaganda. This exhibit was designed by the Electrical Development Association, and the subject could scarcely have been dealt with in a more interesting manner.

The Model All-Electric Kitchen, complete with washing machine, cooker, floor polisher, etc., flashes from good to bad lighting in conjunction with a telling electric sign, while two window displays which are built into the structure will undoubtedly prove most instructive to the public.

One of these windows shows the E.L.M.A. " Lady of Light " display in a new and improved form, while the other indicates the progress in light sources from the crude oil lamp to the modern electric, and incidentally shows the improvement in efficiency on a basis of candle-power per heat unit consumed.

Two external lighting features in the form of stainless steel pylons some 13 ft. 6 ins. in height (loaned by Messrs. Thomas Firth and Sons, Limited) serve to emphasize the modern tone which is noticeable throughout the whole exhibit.


FIG. 3.—A General View of the Stand.

In reviewing this display as a whole, one is impressed with the fact that we are rapidly passing from the age when artificial light is used purely for the purpose of assisting vision to an era in which artificial light is attaining its true status as an art, and plays an important part in furnishing, decoration and architecture.

## Personal

We are informed by the Horstmann Gear Co. Ltd. that Mr. E. Glover Clark has now been appointed their North of England representative for the sale of Newbridge automatic lighting appliances—gas controllers and electric time switches.

# An Interesting School Lighting Installation

The " Lyfa " fittings have been installed in the Cardinal Vaughan School, Kensington. In the accompanying illustration they are seen in the Hall, which is in constant use for art classes, lectures, as well as for speech days and other school functions.

The dimensions of the room are 80 ft. by 37 ft. by 35 ft. The walls are coloured a dull chrome, relieved with dark olive painted dado and pillars at the bays. The floor is dark wood, polished, and the woodwork of the doors is dark pitch pine. The twelve fittings here displayed each take 150 watts. They are No. 2 " Lyfa " fittings, with shades 22 ins. diameter, spaced 14 ft. apart and mounted 11 ft. high.

A night photograph showing the Artificial Lighting of the Hall in the Cardinal Vaughan School, Kensington.

The photograph which was taken and reproduced by kind permission of the Rev. John G. Vance, M.A., the headmaster, gives a good idea of the effect of these somewhat novel fittings. A feature is the absence of glare and good diffusion of light, and the hall appears quite well lighted, though this is perhaps not fully revealed in the photograph owing to the dark texture of the floor. We understand that the lighting has given complete satisfaction. The installation was carried out by Messrs. E. and C. Champion, of Sutton, Surrey.

The lighting of halls and assembly rooms in schools often presents an interesting problem to the illuminating engineer. The requirements are somewhat different from those in a classroom, the main considerations being that the lighting should be cheerful but free from glare, and that the lighting units should be mounted high up, leaving a clear view down the hall.

## A Study of Heating and Ventilation in Schools

A Report (No. 58) on the above subject by H. M. Vernon and T. Bedford has been issued by the Industrial Health Research Board and is available from H.M. Stationery Office (2s. 6d. net). Special interest attaches to the remarks on semi-open-air schools which can be warmed. The latest modern methods of heating are described and there are a number of excellent illustrations. At the end of the booklet there is a complete list of other reports issued by the Board which now make an imposing total.

## Sheffield Illumination Society

OPENING MEETING OF THE SESSION.

The first meeting of the Sheffield Illumination Society for session 1930 was held on the 5th February at the Corporation Lighting Department, when a paper entitled "Office Notes" was delivered by Mr. E. Marrison (Hon. Secretary of the society).

In his opening remarks the Hon. Secretary stated that 22 lectures have been given to the society since its inauguration on 7th October, 1924, and that the present syllabus contained contributions from members only, no outsiders appearing as in former years. The object of this procedure is to assist in extending the technical knowledge of the Lighting Department employees. A tribute was paid to the various gentlemen who have given lectures to the society.

The varied activities in the office of a Lighting Department were enumerated in detail by the speaker, and the information proved interesting and educative.

Graphs were prepared showing how the expenditure of the department is allocated for the present financial year; the total increase of the candle-power of the lamps as against the net expenditure; also the increase in the number of public lamps during the last six years.

It was pointed out that wages, gas, electric current and maintenance of the lamps were responsible for 82 per cent. of the total amount allocated. Since April, 1924, to the present year, the increase in expenditure has been equal to 9.19 per cent. and the increase in candle-power 300 per cent. The present figures are £63,000 and over 2,000,000 respectively. This is surely good value for the money expended. During the last six years the number of electric lamps has been increased by 787 per cent., and the gas lamps 31 per cent.

Continuing, Mr. Marrison said: "In spite of the increasing importance of street lighting over the country the amount voted for its upkeep never errs on the side of generosity. This starving of a street-lighting system is unfortunately national, and seems to suggest the need for some educational work among public authorities generally if we are to secure its due recognition and financial support. They apparently do not realize fully the growing importance of street lighting, otherwise the deplorable conditions up and down the country would not exist."

Some figures relating to mantle consumption during the last two years were given, and attention was directed to the fact that it is found in practice that a man who uses a small number of mantles usually has his lamps in a "healthy" condition, proving that carefulness in the handling of lighting plant is a most important matter. When the street lamps are kept up to a high standard of efficiency, the attractiveness of the thoroughfares is increased, and the safety and convenience in those thoroughfares are largely dependent upon that factor. At the same time the street-lighting system is more economical and the value of the department is enhanced.

The President of the society (Mr. G. Sayer) occupied the chair and thanked Mr. Marrison for his informative paper.

## A "Daylight" Installation

The accompanying illustration shows a section of the silk inspection department of the London Holeproof Hosiery Co., where the lighting has recently been reorganized. Workers are engaged in examining silk stockings for possible flaws in manufacture and for colour. Artificial light is required during the whole working day, so that exceptionally good conditions are necessary. The illumination, which represents an increase of 400 per cent. over that previously provided, is obtained from ten 150-watt Osram daylight-blue lamps in standard dispersive reflectors. Since the change was made the staff have been able to note a definite increase in speed and accuracy of work, and it is likely that improved lighting will gradually be installed throughout the entire premises.

## Mazda Lamps and the New "Tote"

The new electric totalizator recently demonstrated at Thirsk Racecourse is fitted with Mazda lamps.


A view of the new electric "Tote" on Thirsk Racecourse, where 10,000 Mazda lamps are in use.

The indicator of the new totalizator, which has been standardized by the Racecourse Betting Control Board, is on the lamp monogram principle, each unit or numeral being formed from a bank of 24 Mazda lamps. Selected groups of lamps are lighted to form luminous figures in accordance with signals transmitted by the adding machines. There are six banks of lamps in line with the number of each horse, and seven banks for the respective totals "win" and "place." Every lamp is light-insulated from its neighbour and is housed in a separated blackened compartment. The banks of lamps are surmounted by a blackened grille, with the result that illuminated figures are clearly visible in bright sunlight from a distance of over 150 yards, and from any angle up to 30°. Approximately 10,000 Mazda lamps are used in the complete totalizator as demonstrated at Thirsk.

## Personal Notes

The Benjamin Electric Ltd. announce that Mr. Towers, who represents them in Northumberland, Durham, Cumberland and Westmorland, has now changed his address to 5, Grosvenor Drive, Whitley Bay, Northumberland.

* * * *

We understand that Mr. Paul H. Mangin, late general manager of Millars Machinery Co. Ltd., has joined the Board of Messrs. Lewenz & Wilkinson Ltd.

A London "soft goods" inspection room illuminated by "GECo" dispersive reflectors and Osram daylight-blue lamps.

# Gas Lighting

*The following are extracts from a paper read by Mr. Frederick J. Gould, Member of the Council, Society of British Gas Industries, before a Joint Gas Conference at the British Industries Fair, Birmingham, on February* 18, 1930.

I HAVE been permitted to state that the Council of the Society of British Gas Industries very deliberately chose the subject of "Gas Lighting" as especially suitable to put before you to-day; first, because of its supreme importance to our industry as a whole, and, secondly, because of its vital interest to the manufacturers of lighting apparatus who are members of the Society of British Gas Industries.

* * *

DOMESTIC LIGHTING.

It is generally accepted that, to give an efficient lighting service and retain it, a maintenance system should be in force. Some undertakings find it necessary to give free maintenance (there is, of course, no free service), but this is a costly matter, and not always possible or desirable. It is calculated that an outlay of 4d. per burner per visit for cleaning ordinary domestic burners barely covers the cost, inclusive of wages and materials; but the sacrifice (say) of half this amount is well worth while.

* * *

There are some who strongly advocate the use of a burner with a fixed ejector standardized and marked to suit the conditions of any given area. In June, 1918, there was some correspondence in the Technical Press on this subject, and the answer to the question raised at that time is the same to-day as then: "Give us equal distribution of pressure and make, and you can have an efficient burner made in this way."

* * *

Your brackets and pendants should be of the best British virgin solid-drawn tube of not less than 19 S.W.G. (0.040). Manufacturers in the "S.B.G.I." adopt decimal markings in defining the gauge of the material they offer you. There is then no confusion in speaking of various gauges.

* * *

Let me tell you what sort of test our British product in solid-drawn tube will stand. The following figures are given by the Government Industrial Research Laboratory:

(*a*) A length of 0.040 tube ½ in. diameter tested for tensile strength gave a load of 2.65 tons=45.9 tons per sq. in.

(*b*) A complete 1-light pendant well designed with ball joint, lever cock, and nosepiece, tube 0.032 (all fittings produced from rodding) properly threaded, submitted to a vertical test broke at the thread connecting the tube to the ball joint, at 2,420 lbs. (22 cwt.).

There is a prejudice in some quarters against the use of fittings made from rodding, and the following tensile tests made with material from both rodding and casting, from which cocks, ball joints, &c., are produced, will be of interest:

(*c*) Tensile test with extruded rodding was 23.4 tons per sq. in.

(*d*) Tensile test with brass casting was 10.36 tons per sq. in.

Apart from the quality of your fitting, the design and standardization of the fitting and its working parts are important. A standard form of construction should be adopted, type of joint, and position of plugs and niting. Half niting should always be used; plugs with quarter niting are liable to be misunderstood by your consumers, and there is the danger of the cock being left at the "on" position. If sufficient care is not taken in the selection of fittings, the undertaking is involved in high maintenance costs. It is always cheapest in the end to purchase the best article. If you analyse your labour costs for attending leaky fittings, you will find them considerable. The sending of a fitter merely to tighten a screw of a badly constructed fitting costs 2s. to 2s. 6d., and in addition you have the risk of constant danger to your slot consumer, and no doubt he is a very important person and takes a fair proportion of your total load. In one large city 27 per cent. of the total output produced by the gas undertakings goes to the slot consumer, and the largest proportion is for lighting.

Attach to your fittings scientifically made burners of the diffuser type for preference, but do *not* attach an opal or flint balloon. Instead, use a neat, fancy shade, in either decorative glass or parchment.

One hears so much of late about the limitations of gas lighting. The six-roomed house is so often mentioned as the largest type in which is it considered that gas can be expected to be used for this purpose. I fear that many of us living in London get accustomed to thinking in terms of the Metropolitan area, and lose sight of the fact that thousands of large houses in the Provinces are efficiently and economically lighted by gas; and gas undertakings should see that their showrooms contain suitable artistic fittings for the better-class house. The old types of two and three arm suspension fittings have disappeared, for use not only with gas, but with electricity, and you have in their place artistic bowl and panel fittings, fitted with cluster burners diffusing a warm, soft, beneficial light.

* * *

The advantages of using gas as an illuminant are so well known that I will not repeat them in greater detail than is necessary. Its use as a ventilating and sterilizing agent; and its comfort to the sight. Here I would

TABLE I.

BRIGHTNESS OR INTRINSIC BRILLIANCY OF SOURCES OF LIGHT

| Source | C.P. per sq. in. | |
|---|---|---|
| Sun .. .. | 800,000 | (A. P. Trotter)* |
| Searchlight, modern | 400,000 | " |
| Electric arc, naked | 20,000 | (J. Darch)† |
| Tungsten electric arc ("Point-o'-Lite") .. .. | 12,900 | (Dr. Thomas and D. Chandler)‡ |
| Tungsten electric filament gasfilled lamp .. .. | 5,250 | (A. P. Trotter) |
| Flame arc .. .. | 5,000 | " |
| Nernst (zirconium electric filament) lamp .. .. | 3,000 | (Dr. L. Bell)§ |
| Tungsten electric filament vacuum lamp .. .. | 1,100 | (Dr. Thomas and D. Chandler) |
| Carbon electric filament lamp .. | 400 (average) | " |
| Gas-mantle high-pressure, inverted | 250 | " |
| Acetylene flame .. | 60 | (A. P. Trotter) |
| Gas - mantle, low-pressure, inverted | 40 | (Dr. Thomas and D. Chandler) |
| Gas - mantle, low-pressure, upright | 23 | (A. P. Trotter) |
| Frosted tungsten electric filament vacuum lamp .. | 10 | " |
| Argand gas flame.. | 7·5 | (Dr. Thomas and D. Chandler) |
| Petroleum lamp flame .. .. | 4 to 9 | (A. P. Trotter) |
| Batswing gas flame‖ | 3 to 4 | " |
| Candle flame .. | 2·5 | " |
| Sky (average brightness) .. .. | 2·5 | (Dr. Thomas and D. Chandler) |
| Moon .. .. | 2·0 | " |

* Taken from *Illuminating Engineering*.
† Taken from *Trans. Roy. San. Inst.*, Vol. XXXI., No. 10.
‡ Taken from *Illumination by Gas*—one of the World Power Conference Papersr read in July, 1924.
§ Taken from *The Art of Illumination*.
‖ NOTE.—Presumably when burning 16 c.p. gas under the old illuminating power standard.

remind you of the great danger that arises from brilliant unshaded sources of light placed in the direct line of vision. The human eye cannot, without discomfort, endure a greater brilliancy in the source of light which is entering it, either directly or indirectly, than about 5 candle-power per sq. in. of lighting source—namely, about the intrinsic brilliancy of an Argand burner or an oil lamp. The inverted incandescent gas mantle has a brilliancy of 40 candle-power per sq. in. of source, and, therefore, needs a diffusing globe of about eight times its area to give a perfect light. Othere values are given in Table I.

You will note that the tungsten electric filament vacuum lamp has a brilliancy of 1,000 candle-power per sq. in. The rays of light emanating from an incandescent gas mantle contain a larger percentage of green rays than those proceeding from any form of metal filament incandescent electric lamp. These green rays are extremely beneficial, and the mechanism of the eye is particularly sensitive to them.

Tables II and III give colour comparisons of various artificial illuminants with daylight.

TABLE II.

EXTRACTS FROM DR. NICHOLS' TABLE CONTAINING COLOUR COMPARISONS OF VARIOUS ARTIFICIAL ILLUMINANTS WITH DAYLIGHT

| Colour and wave-length | ILLUMINANT | | | | | | |
|---|---|---|---|---|---|---|---|
| | Daylight (White Sky) | Oil Flame | Acetylene Flame | Incandescent Gas Mantle (Low Pressure) | Electric Arc (Plain Carbons) | Electric Incandescent Vacuum Lamps | |
| | | | | | | Tungsten Filament | Carbon Filament |
| Red, 65$\mu$ | 1·00 | 1·84 | 1·38 | 1·22* | 1·15 | 1·30 | 1·38 |
| Green, 55$\mu$ | 1·00 | 0·70 | 0·78 | 0·97* | 0·91 | 0·80 | 0·77 |
| Blue, 45$\mu$ | 1·00 | 0·25 | 0·45 | 0·70* | 0·60 | 0·42 | 0·40 |

* "Old (1894) mantle." A "new (1908) mantle" gave different values—viz., 1·16 0·84 and 0·45 for red, green, and blue, respectively.

$\mu$ = one millionth of a centimetre. Some people use the micro-millimetre—i.e., one millionth of a millimetre; and the wave-lengths are then written (for example) 650 $\mu\mu$.

N.B.—While the experiments of Nichols, as presented by Gaster and Dow in their oft-referred-to work, make available a complete comparison of colour intensities throughout the spectra of various illuminants, there are here given only the relative strengths of three colours (those which are respectively nearest to the three primary colour sensations of the eye), since these measurements are sufficient to enable us—without separately measuring the intensities of all the colours along the spectrum—to infer the composition of the light which proceeds from any source yielding a continuous spectrum.

These properties, together with the comparatively generous area of its radiating source of relatively low intrinsic brilliancy, gives us a source which we justly claim as unsurpassed in quality; and, to quote Mr. W. A. Bishop: "We judge of the quality of an illuminant by its wave length characteristics. The resultant composite effect of these radiations, as evidenced by its colour, and by its softness or degree of diffusion as manifested by its order of intrinsic brilliance"; and we therefore claim that gas is the best artificial illuminant for the sight.

* * *

## Illumination.

With regard to gas consumption and the resultant illumination in dealing with commercial gas lighting, there should be a simple table of working allowances.

The following table suggests certain values of illumination in foot-candles for different purposes:—

| | Foot-candles* |
|---|---|
| Foundries | 1½—2 |
| Printing works | 3—5 |
| Engineering workshops | 3—5 |
| Workshop machines, lathes, etc. | 3—5 |
| Fine work, watch making, artistic chasing, etc. | 7—10 |
| Spinning sheds | 2—3 |
| Wood working shops | 3—4 |
| Drawing offices | 4—6 |
| General | 3—4 |
| Schoolrooms | 3—4 |
| Churches | 2—3 |

* The foot-candle is the illumination produced by a light flux of one lumen uniformly distributed over an area of one square foot. The lumen represents the quantity of light falling on one square foot of the surface of a sphere of one foot radius from a light source of one candle intensity placed at the centre of the sphere.

Corresponding to this table are the following specific consumptions which may help in calculating the number and sizes of lamps required to produce definite degrees of illumination:—

| System of Lighting | Consumption in Cubic Feet of 500 B.Th.U. Gas per Hour per Foot-Candle per Sq. Ft. of Surface Illuminated. |
|---|---|
| Direct lighting | 0·008 |
| Semi-indirect lighting | 0·012 |
| Indirect lighting | 0·016 |

(The value for "Direct Lighting" refers to units of an extensive type.)

It is necessary that careful attention be given to the choice of the burners or lamps and their general layout to avoid shadows and undue contrasts:—

*Example*

Take an area of a building in sq. ft. (say) 50 × 100 = 5,000

Multiply by foot candles required, we will say 2 5,000 × 2 = 10,000

Multiply by consumption suitable for direct lighting: 0·008 0·008

80·000

This gives you 80 c. ft. of gas per hour required.

We decide to use No. 2 burners consuming 2½ c. ft.

25 ) 800 ( 32
75
50

32 No. 2 burners required = four 8-light or eight 4-light lamps,

and in dealing with large spaces—such as workshops and factories—gas has always a splendid opportunity. I was recently told of a gas undertaking in London competing with the electricity undertaking for the lighting of a very large factory. It was decided to put up two test installations—gas and electricity—and the gas installation, after photometric tests (carried out by the electrical undertaking), was fully approved. Gas was installed throughout the buildings!

## Public Lighting.

With such splendid examples of street lighting given us in London, Birmingham, and other important cities, it is perhaps no wonder that gas more than holds its own. The Association of Public Lighting Engineers, under the able Presidency of Mr. S. B. Langlands, has done some very valuable work, and a great deal has been achieved towards improved street lighting by decreasing the diversity factor; but considerably more requires to be done. We should not wait until there is a possibility of losing public lighting before we show the responsible authorities what can be done by suitably spaced high power lamps.

* * *

In another London district in which there is an arterial road you have one of the finest examples of road lighting in the Kingdom, and it is gas lighted. The portion that is completed was not won for gas without intense competition. The gas and the electricity undertakings were given an opportunity of showing what they could do, and after two years' test the authorities decided in favour of gas. In this case, 600 candle-power lamps are erected, and suspended on columns 16 ft. from ground-level and in the centre of the road, 100 ft. apart. So far, approximately 2½ miles have been lighted. The road is 11 miles in length and passes through the areas controlled by no fewer than five different councils. This installation has been most favourably commented upon by the Ministry of Transport, and many public officials have been to see it.

* * *

The ordinary 14-in. and 16-in. street lamp should have, if I may suggest it, all ordinary universal types of burner removed, and replaced by superheated cluster lights of two or three No. 1 bijou mantles. From a three-light you can secure a duty of 165 M.H.S.C.P. consuming 5.50 cubic ft. per hour; and by judicious use of refracting plates, chromium plated deflectors, and other means, you can bring your lamps up to date. Mr. Robert Watson, of Doncaster, has dealt well with this subject; and I would like to refer you to an article

TABLE III.—EXTRACTS FROM DR. VOEGE'S TABLE CONTAINING COMPARISONS OF ARTIFICIAL ILLUMINANTS WITH DAYLIGHT

| Colour | Daylight | | | Electric Incandescent Light | | Electric Arc Light Plain Carbons | Incandescent Gas Light | Acetylene Flame | Oil Flame "Reform" Burner |
|---|---|---|---|---|---|---|---|---|---|
| | White Sky | Blue Sky | Sunlight | Carbon Filament Lamp | Tungsten Filament Lamp | | | | |
| Red .. .. .. .. | 1·00 | 0·77 | 0·90 | 1·76 | 1·63 | 1·35 | 1·20 | 1·37 | 2·18 |
| Green .. .. .. .. | 1·00 | 1·33 | 0·85 | 0·79 | 0·86 | 0·97 | 0·89 | 0·86 | 0·74 |
| Blue .. .. .. .. | 1·00 | 1·65 | 0·65 | 0·20 | 0·23 | 0·75 | 0·23 | 0·27 | 0·12 |

N.B.—As in the case of Table II, only the three colours which are respectively nearest to the three primary colour sensations of the eye have been taken from Dr. Voege's table for inclusion here.

TABLE V.

| Type of Burner (Unscreened Sources) | A | | | B | | |
|---|---|---|---|---|---|---|
| | B.Th.U. per Candlepower-Hour | | | Candlepower-Hours per Therm | | |
| | Mean Horizontal C.P. Rating ($I_h$) | Mean Spherical C.P. Rating ($I_o$) | Mean Hemispherical C.P. Rating ($I\supset$) | Mean Horizontal C.P. Rating ($I_h$) | Mean Spherical C.P. Rating ($I_o$) | Mean Hemispherical C.P. Rating ($I\supset$) |
| No. 1.—"C" upright .. .. .. .. .. | 34 | 45 | .. | 2940 | 2220 | .. |
| No. 2.—No. 4 "Kern" upright .. .. .. | 29 | 38 | .. | 3450 | 2630 | .. |
| No. 3.—Ordinary inverted—large, medium, and bijou sizes .. .. .. .. .. | .. | .. | 25 | .. | .. | 4000 |
| No. 4.—Twin (No. 1 mantle) preheated inverted .. | .. | .. | 19 | .. | .. | 5260 |
| No. 5.—Four, five, and six (No. 2 mantle) preheated cluster inverted .. .. .. .. | .. | .. | 16 | .. | .. | 6250 |
| No. 6.—High-pressure inverted (80 in. w.g.—gas pressure system) .. .. .. .. | .. | .. | 10·5 | .. | .. | 9520 |

TABLE VI.—STATEMENT OF COMPARATIVE COSTS OF MANUFACTURING LIGHT BY DIFFERENT METHODS.

| Method of Manufacturing Light | Weight or Volume of Material, No. of B.Th.U. and Quantity of Electric Energy Required per Candlepower-Hour (Approx.) | Cost | | |
|---|---|---|---|---|
| | | Pence per Candlepower-Hour (Approx.) (*a*) | Pence per 1,000-Candlepower-Hours (Approx.) (*b*) | Candlepower-Hours Purchased for 1s. (Approx.) (*c*) |
| By (1) candle (ordinary commercial type) .. .. | 0·017143 lb. (horizontal rating) | 0·085715 | 85·715 | 140 |
| „ (2) oil— | | | | |
| (*a*) Domestic wick lamp .. .. .. .. | 0·00119 gall. „ „ | 0·01666 | 16·66 | 720 |
| (*b*) „ incandescent mantle lamp* .. .. | 0·000216 „ „ | 0·003024 | 3·024 | 3,960 |
| „ (3) town gas— | | | | |
| (*a*) open flame burner .. .. .. .. | 0·4 c. ft.† | 0·01200 | 12·00 | 1,000 |
| (*b*) low-pressure upright incandescent burner | 45 B.Th.U. (m.s.c.p. rating) | 0·00360 | 3·60 | 3,333 |
| „ inverted „ „ .. | 34 „ (horizontal „ ) | 0·00272 | 2·72 | 4,412 |
| „ „ „ pre-heated cluster burner .. .. .. .. .. | 25 „ (m.h.c.p. „ ) | 0·00200 | 2·00 | 6,000 |
| high-pressure (80 in. W.G.) inverted incandescent pre-heated burner .. .. | 16 „ ( „ „ ) | 0·00128 | 1·28 | 9,375 |
| „ (4) acetylene— | 10·5 „ ( „ „ ) | 0·0084 | 0·84 | 14,286 |
| (*a*) open-flame burner .. .. .. | 0·025 c. ft. $C_2H_2$; or 0·0055 lb. $CaC_2$ (horizontal rating) | 0·01100 | 11·00 | 1,080 |
| (*b*) inverted incandescent burner .. .. | 0·010 c. ft. $C_2H_2$; or 0·0022 lb. $CaC_2$ (horizontal rating) | 0·00440 | 4·40 | 2,700 |
| „ (5) petrol-air gas used in inverted incandescent burner .. .. .. .. .. | 0·000128 gall. (m.h.c.p. rating) | 0·002176 | 2·176 | 5,506 |
| „ (6) electric energy— | | | | |
| (*a*) carbon filament lamp (low efficiency, 800 hours' life type) | 4·05 watts (m.h.c.p. rating) equivalent to 13·85 B.Th.U. | 0·02025 | 20·25 | 592 |
| (*b*) „ „ „ (high efficiency, 400 hours' life type) | 3·52 watts (m.h.c.p. rating) equivalent to 12·04 B.Th.U. | 0·01760 | 17·60 | 682 |
| (*c*) metal filament lamp (vacuum type) .. | 1·25 watts (m.h.c.p. rating) equivalent to 4·27 B.Th.U. | 0·00625 | 6·25 | 1,920 |
| (*d*) „ „ „ (gasfilled type) .. | 0·66 watt (m.h.c.p. rating) equivalent to 2·26 B.Th.U. | 0·0033 | 3·30 | 3,636 |
| (*e*) arc lamp (ordinary or plain carbon type) | 1·25 watts (m.s.c.p. rating) equivalent to 4·27 B.Th.U. | 0·00625 | 6·25 | 1,920 |
| (*f*) „ „ (flaming or impregnated carbon type) .. .. .. .. .. | 0·265 watt (m.s.c.p. rating) equivalent to 0·91 B.Th.U. | 0·001325 | 1·325 | 9,056 |

* Upright mantle type. A much higher efficiency is claimed on behalf of certain oil-vapour inverted mantle lamps of relatively high luminous output (say, 300 c.p. upwards). These high-power incandescent oil lamps are spoken of in the text.

† 16 c.p. quality—old illuminating power standard. Price (say) 2s. 6d. per 1,000 c. ft.

In the table, columns (*a*) and (*b*) have been calculated from the quantities given in the first column, but in certain cases the values in column (*c*) have been determined on the basis of the number of candlepower-hours provided by 1 lb. of candles, 1 gall. of oil, etc., at the listed prices. Since, in the reduction of these values from candlepower-hours per lb. or gallon to the decimal fractions of the lb. and gallon per candlepower-hour, some of the values in the first column have had to be approximated to restrict the number of figures, one or two of the end column values (*c*) will differ very slightly from the tabulated values if one evaluates them on the basis of the approximate quantities in columns (*a*) or (*b*), because, as already explained, the figures in column (*c*) have been derived from the number of candlepower-hours (as mentioned in the text) bought in the form of lb. of candles, 1 gall. of oil, etc.

NOTE.—The monetary values in the above table are related to the following fair average purchase prices of the materials and electric energy involved in the light-making processes under review:

(1) Commercial candles .. .. .. per lb. 5d.
(2) Kerosene oil, flash-point 110° F. .. per gall. 14d.
(3) Town gas .. .. .. .. .. per therm 8d.
(4) Calcium carbide .. .. .. per lb. 2d.
(5) Petrol .. .. .. .. per gall. 17d.
(6) Electric energy .. .. .. per kilowatt-hour 5d.

written by him: GAS JOURNAL, February 20, 1929, "Directional Gas Lighting for Streets." Mr. Watson shows us very clearly by his own tests the possibilities, without alteration of existing lamp positions, of increased illumination along the road surface. When contemplating such alterations, re-arrangements, or extensions to existing installations, aim at the higher lighting values, and do not be too anxious about economy, because, after all, a lighting scheme is eventually, fortunately or unfortunately, judged on its merits when economy is forgotten.

* * *

DISTANCE LIGHTING.

The various types of distance control devices which are well known to you in every case have the disadvantage of by-pass attachments. There is a new device which, I think I may say now definitely, will shortly be on the market. With this you have a switch control to the burner which has no by-pass. A form of catalyst is controlled from the bunsen tube, and the burner may be turned on and off from a distance just in the same way that you control an electric lamp. This device should be a great advantage to the industry.

It is not possible to deal in the limited time at my disposal with the many other points that arise in one's mind when thinking of this subject. I have only briefly touched upon some of them, but, in conclusion, I would ask you to give this matter your earnest attention. Demonstrate up-to-date domestic lighting in your showrooms, and in your window displays. Why not appoint a gas lighting salesman to look after lighting and nothing else? To quote Mr. W. M. Mason, "It is so easy for the salesman to take the line of least resistance, and if you can come in with an order for a dozen gas fires or cookers or a big installation, it is very nice; but it is very difficult to plod along in the old way and retain what we have got. That can only be done by an enthusiastic chap who knows what he is talking about, is keen on the job, and is encouraged to do it!"

## Surveying Public Lighting

The second lecture for session 1930 of the Sheffield Illumination Society was delivered on the 17th March by Mr. E. Selwood at the Corporation lighting department, the subject being "Surveying."

The speaker gave a detailed outline of the many duties of the lighting department employees, and pointed out how necessary it was for those duties to be carried out in the most efficient way to ensure that the city was well lighted. Mr. Selwood stated that surveyors were appointed to inspect the lighting generally and issue reports concerning same, and in this respect the public also rendered very valuable service in the reporting of faults, etc. A very good discussion followed.

## E.L.M.A. Lighting Service Bureau

TWENTY-FIRST ILLUMINATION DESIGN COURSE.

We note that the twenty-first Illumination Design Course of the E.L.M.A. Lighting Service Bureau will commence on Monday, May 5th, and will be completed on Thursday, May 8th. A wide range of subjects is promised, among the titles of lectures being: "Lighting Yesterday and To-day," "Light and Visibility," "Electric Lamps and Their Characteristics," "The Lumen Method of Design," "Industrial Lighting," "Lighting for Special Industries," "A Factory Lighting Design," "Light and the Shopkeeper," "Uses of Light in the Shop," "Electrical Advertising," "School and Office Lighting," "Possibilities of Home Lighting," "Light and Architecture," "Architectural Lighting," "Street Lighting and Traffic Control," "Special Lighting Problems," "New Lighting Fields," "Salesmanship" and "Lighting Service."

The course promises to be an attractive one. Those interested should apply to the E.L.M.A. Lighting Service Bureau, Savoy Street, Strand, London.


## ARTIFICIAL LIGHT AND VISION.

SIR,

Your publication for March contains an editorial entitled "Artificial Daylight."

*The Evening Standard,* for March 11th, reported a debate in the Commons, in which Lord Erskin "pointed out that colour-blindness was increasing among the population of this country." May I submit one possible explanation of this phenomenon : the increased use of artificial light in which the red and infra-red rays abound at the expense of the blue and violet radiations? It would appear to be a satisfactory assumption that a surfeit of red light rays increases the effort of the eye to distinguish the colours of the less penetrating radiations. Effort is undoubtedly healthy, but over-exertion is likely to produce fatigue and strain.

My dictionary describes " glare " as " oppressive, unrelieved sunshine"; am I right in the assumption that " glare " is the effect of excessive radiation in the red and infra-red field of the spectrum?

I would welcome criticism of these submissions, but should there be a grain of truth in them, may the B.E.S.A. prove fertile ground for its reception and growth. And may this Committee define, once and for all, this illusive word " glare "; that the Illuminating Engineers can join hands on the road to this unattained ideal of " glareless light."

Yours faithfully,

RAYMOND WALKER.

* Philosophical Transactions of the Royal Society, 1914, Vol. 214 A; " Sir William Crookes and Effect of Light Radiation on the Eye.

SIR,

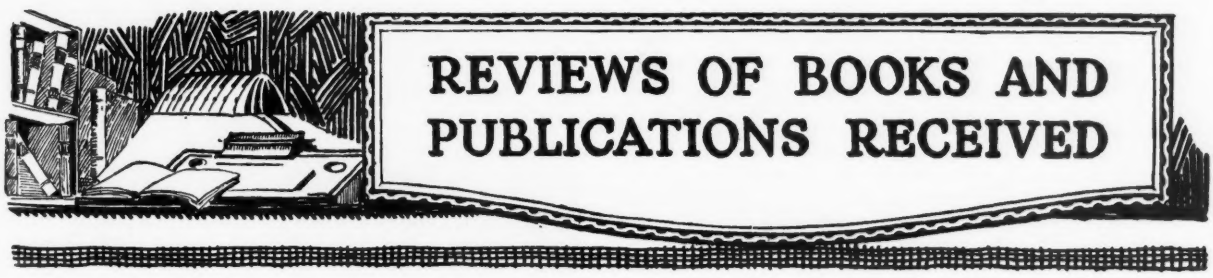
Mr. Walker's letter expresses a view that one meets rather constantly—that the excess of red and orange in artificial light as compared with daylight is in some way predjudicial to the eyes. Opinion seems to be divided on the question whether sustained close vision is more comfortable by corrected artificial light. There seems no scientific ground for the impression that the slight excess of the red and orange end of the spectrum is in some way injurious to eyesight, still less that it can be regarded as a potential source of colour-blindness which, we believed, is almost invariably an inherited quality and not one acquired during life (except possibly in the case of certain well-marked diseases such as " tobacco-blindness"). At intervals one hears the view expressed that the national eyesight is progressively deteriorating in some respects. At the moment the " red " or " infra-red " rays are blamed. The writer can recall a paper some years ago in which the trouble was ascribed to the alleged " ultra-violet " rays emitted by electric lamps; to-day such radiation would probably be hailed as a benefit!

I doubt whether ophthalmic surgeons would agree that eyesight to-day is in any degree worse than that of a past generation, accustomed to meagre degrees of artificial illumination which we should consider intolerable. But even so, it would be rash to attribute this to the influence of artificial light.

In conclusion, I would like to protest against the confusion of " glare," which is at present associated with excessive brightness, with *colour* of light One not infrequently finds this confusion encouraged by advocates of artificial daylight, on whom red light seems to have an unduly exciting effect. But the idea is essentially unscientific and liable to complicate what is already sufficiently involved.

Yours,

ONLOOKER.




THE PRACTICAL ELECTRICIAN'S POCKET BOOK. (" *Electrical Trading,*" *London,* 1930; *pp.* 544; *2s. 6d. net.*)

The thirty-second annual edition of " The Practical Electrician's Pocket Book " makes a welcome appearance. It will be recalled that an entirely new edition was published last year. The 1930 edition, therefore, naturally contains fewer new features, though it has been revised and several sections dealing with synchronous and asynchronous motors, fault localization, medical electricity and the simple law of contracts have been added. The section on illumination occupies 25 pages and is followed by a section dealing with the control of lighting circuits. It follows familiar lines and the space is in the main well utilized, though one has some doubts whether the eight pages devoted to tables of coefficients of utilization, etc., might not be better applied to fuller discussion of lighting problems. The volume contains nearly 550 pages of small type and remains, as ever, a remarkable example of cheap production at the very moderate price of half a crown.

THE GAS WORKS DIRECTORY AND STATISTICS. (*Heywood & Co. Ltd., London,* 1930; *pp.* 659; *10s. 6d. net.*)

The forty-second issue of this directory, for which the publishers of *The Gas Engineer* are responsible, contains a vast amount of statistical information. Sections I to IV give figures of interest for gas works in England and Wales, Scotland, Ireland, and in the Colonies and foreign countries. Following this there is a list of associations of engineers and managers and a general index of officials of gas undertakings. The information given regarding the performances of gas undertakings is exceptionally complete. Besides the usual financial information one notes particulars of the make of gas, cost of coal and price at which gas is supplied, numbers of meters and public lamps, length of mains, etc. In addition the date of adoption of the therm system and the declared calorific value are usually mentioned. The directory ought to be of considerable service to those associated with the gas industry.

# TRADE NOTES & ANNOUNCEMENTS

## THE LIGHTING OF THE PLOUGH INN, CLAPHAM.

We are indebted to the courtesy of the General Electric Co. Ltd. for the two adjacent pleasing illustrations showing the application of flood lighting to the Plough Inn, Clapham. The specially designed G.E.C. units are mounted on posts on the pavement the outer faces of the lantern consisting of diffusing glass. A near view of the unit, in which an attempt is made to carry on the "old world" effect, is shown on the right, whilst the picture above shows the general appearance of the building by night.

## ARTIFICIAL LIGHTING UNITS FOR PHOTOGRAPHIC WORK.

At the present time artificial light plays an ever-increasing rôle in photographic work, not only in the studio but in any place where it is desired to take photographs of interiors, groups of people or machinery in position in the factory, etc. It may, therefore, be expedient to refer to a few types which have been introduced by Messrs. Korting & Mathiesen Electrical Ltd. Such devices may be divided into two groups, those utilizing arcs and those utilizing high candle-power incandescent (gasfilled) lamps. An example of the former type of unit is shown in Fig. 1. The apparatus shown in Fig. 1 uses two open arcs with flame carbons, which are enclosed in a box-reflector of good reflecting power. A diffusing glass screen is provided and the whole apparatus is mounted on an adjustable and collapsible tripod stand, with the necessary resistance and switch assembled at the base. This lighting unit can be connected direct to the electric supply, and it is designed for all ordinary voltages and for either direct or alternating current. The apparatus illustrated in Fig. 2 is adapted for incandescent lamps up to 3,000-watt capacity.

For larger studios the composite units as shown in Fig. 3 may be used. The frame carries 15 reflectors each equipped with a 500-watt gasfilled lamp. The reflectors are adjustable to allow for concentrating the light on a relatively small area or spreading it over a larger area according to the object to be photographed, and are so designed as to illuminate in each case the area quite evenly. The model illustrated is mounted on a tripod base with rollers, but similar equipment for overhead lighting is also available

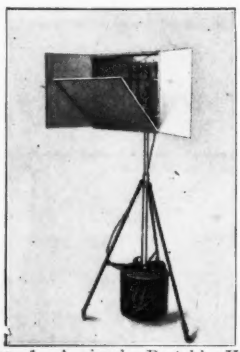


FIG. 1.—A simple Portable Unit comprising two open arcs with diffusing screen.

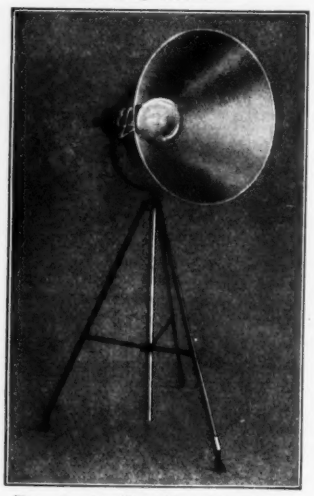


FIG. 2.—Another Portable Unit, using incandescent lamp in a deep white-enamelled reflector, capable of rotation and with focussing adjustment.

FIG. 3.—A Complete Unit with Equipment for fifteen 500-watt gasfilled lamps, mounted on transportable tripod stand with rollers. The reflectors are adjustable, enabling the spread of the beam to be varied. The frame containing the lamps may be raised or lowered by means of a winch, or rotated about a vertical axis. The switchboard is assembled at the base of the tripod and is detachable.

## CONTRACTS CLOSED.

The following contracts are announced :—

METRO-VICK SUPPLIES LTD. :—

*Metropolitan Borough of Islington;* for one year's supply of electrical accessories.

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD. :—

*The Admiralty;* for a large supply of Siemens vacuum and gasfilled pearl lamps; also clear gasfilled lamps.

*Government of Northern Ireland;* 12 months' contract for Siemens electric lamps, vacuum and gasfilled and other materials.

## Exhibits at the Ideal Home Exhibition

We have already received a few particulars of exhibits and demonstrations being staged for the Ideal Home Exhibition. A feature of the B.T.H. stand is a tableau based on the well-known Mazda advertisement, "Beauty Enriched by Light." A graceful figure of a ballet girl, illuminated by concealed projectors, is posed in front of a wine-coloured curtain. In the foreground a translucent floor is suffused with soft light, constantly changing in colour and intensity. On either side there are curtains, behind metal grilles of arabesque design, glowing "with the varying hues of an autumn sunset." Illuminated fountains also project streams into the air. The tableau is admirably designed to illustrate the possibilities of "painting with light." Over 400 Mazda lamps are used in this display and the total connected load is about 22 kw.

Equally novel and interesting are the displays in the G.E.C. "Palace of Light," and the various tableaux in the Ediswan exhibit.

We are also informed by Messrs. Siemens Electric Lamps & Supplies Ltd. that they are supplying all the electric lighting fittings and Siemens lamps for lighting the Frewen Cavity Brick House, which has been erected by the British Cavity Brick and Tile Works Ltd. All the latest methods of lighting sitting rooms, kitchen, bedroom, etc., are shown.

The applications of gas, both for lighting and heating, are effectively demonstrated, one special feature being the popular form of fire in which coke in combination with gas is used. The lighting of the conjoint gas exhibit is of an enterprising character, general use being made of concealed lighting effects which closely resemble those attained with electrical lighting.

A fuller account of the lighting arrangements at this Exhibition will appear in our next issue.



# INDEX (April, 1930).